

MAR 20 1915  
MAR 20 1915  
MAR 20 1915

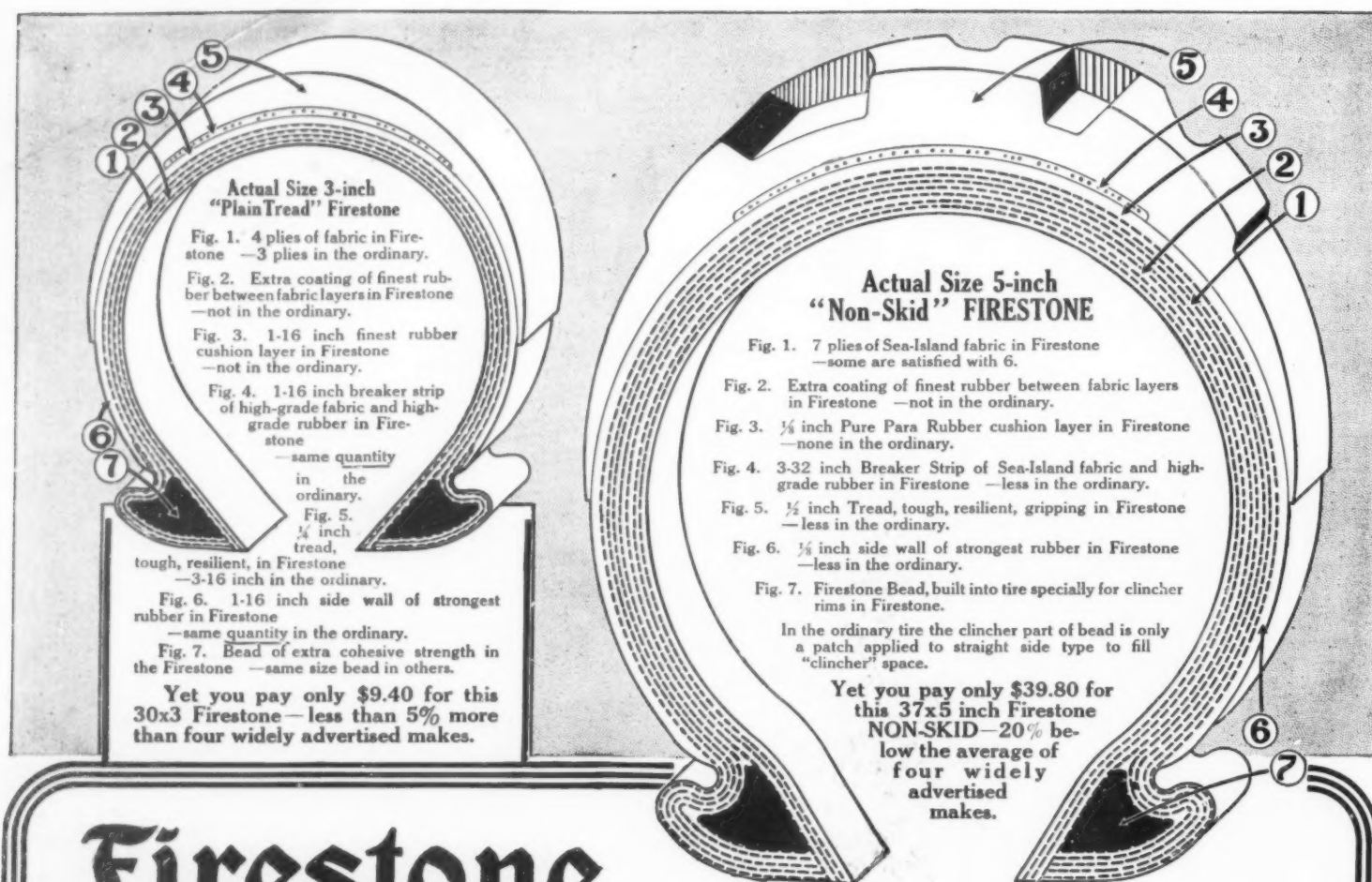
# SCIENTIFIC AMERICAN



Vol. CXII. No. 12  
March 20, 1915

Munn & Co., Inc., Publishers  
New York, N. Y.

Price 10 Cents  
\$3.00 A Year



# Firestone

## Has Done Better than Meet Popular Prices

HERE are two examples: a small size, 30 x 3 plain tread, and a large size, 37 x 5 Non-Skid. Each shown actual size. The same relative values apply in all sizes. Note the detailed specifications of sections as outlined above. Then ask any neutral repair man which manufacturer gives the most in quality. He cuts into all makes of tires. He knows.

You want that extra layer of fabric in the Firestones—4 plies instead of 3 in the small—7 plies instead of 6 in the large size.

You want that cushion stock in the Firestone. There is none of it in the so-called "popular" priced tires. Yet it is impossible to build a full service tire without a cushion layer under the breaker strip. You must have it to prevent bruising and overstraining the fabric.

Firestone Tires have never been built down to a price. You will find everything in a Firestone that ought to be there.

Firestone Tires are vulcanized by the "two-cure" process. This is more expensive than the "one-cure,"

but it allows rigid inspection in the making and eliminates fabric buckles and other defects.

And you want the Firestone bead on that big tire for your safety as well as economy. Designed, built and cured into the tire specially for a clincher rim. Some have clincher beads that are merely patched onto straight side types.

### The Sections Show These Things — The Wear, the Mileage, Prove Them

Yet you pay only 40 cents more for this small Firestone than the ordinary. And only a trifle more in proportion for the larger sizes. Because the much greater surface of the big tires demands so much more of this most expensive rubber and fabric.

And remember the little more you pay for the Firestone Non-Skid gives you a lot more tread. Ordinary anti-skids contain no extra rubber. You are asked to pay more just for a pattern. No extra rubber, no real skid protection, such as Firestones offer.

Take the word of the specialists of the industry—take the record of the Firestone Tires for 15 years—as your authority that these extras of quality are necessary for real service and true economy.

Less material and lower grades are traps to make sales on prices.

The Firestone organization, the largest in the world specializing on tires, can make and market tires and tubes at the lowest possible cost to you, the user.

The tires and prices prove it beyond argument.

### Firestone Tube Prices Give Added Proof of Firestone Savings to You

Firestone is below them all on tubes. WHY?

A tube is good or bad to the eye and the touch. Quality can and does vary, weight can be and is skimmed, but not so radically as in tires. The buyer won't have it. Having to come near meeting Firestone quality in tubes others must go above Firestone in price.

Because, as stated, Firestone manufactures and markets at the minimum cost to you.

But we are no more proud of giving you the best tube below the others than we are of giving you the best tire for so little more.

And the proof of appreciation among car owners lies in the fact that their demand for Firestones last year established 50 per cent more dealers for us and increased our output 78 per cent.

So compare the tires inside. Compare the prices. Compare the service-records among your acquaintances—then get Firestones from your dealer and enjoy

**Most Miles per Dollar**

**FIRESTONE TIRE AND RUBBER COMPANY**

"America's Largest Exclusive Tire and Rim Makers"

Akron, Ohio

Branches and Dealers Everywhere

Firestone Net Price List to Car-Owners

|            | Case Round Tread | Case Non-Skid | Grey Tube | Red Tube |
|------------|------------------|---------------|-----------|----------|
| 30 x 3     | \$ 9.40          | \$10.55       | \$2.20    | \$2.50   |
| 30 x 3 1/2 | 11.90            | 13.35         | 2.60      | 2.90     |
| 32 x 3 1/2 | 13.75            | 15.40         | 2.70      | 3.05     |
| 34 x 4     | 19.90            | 22.30         | 3.90      | 4.40     |
| 34 x 4 1/2 | 27.30            | 30.55         | 4.80      | 5.40     |
| 36 x 4 1/2 | 28.70            | 32.15         | 5.00      | 5.65     |
| 37 x 5     | 35.55            | 39.80         | 5.95      | 6.70     |
| 38 x 5 1/2 | 46.00            | 51.50         | 6.75      | 7.55     |



SEVENTY-FIRST YEAR

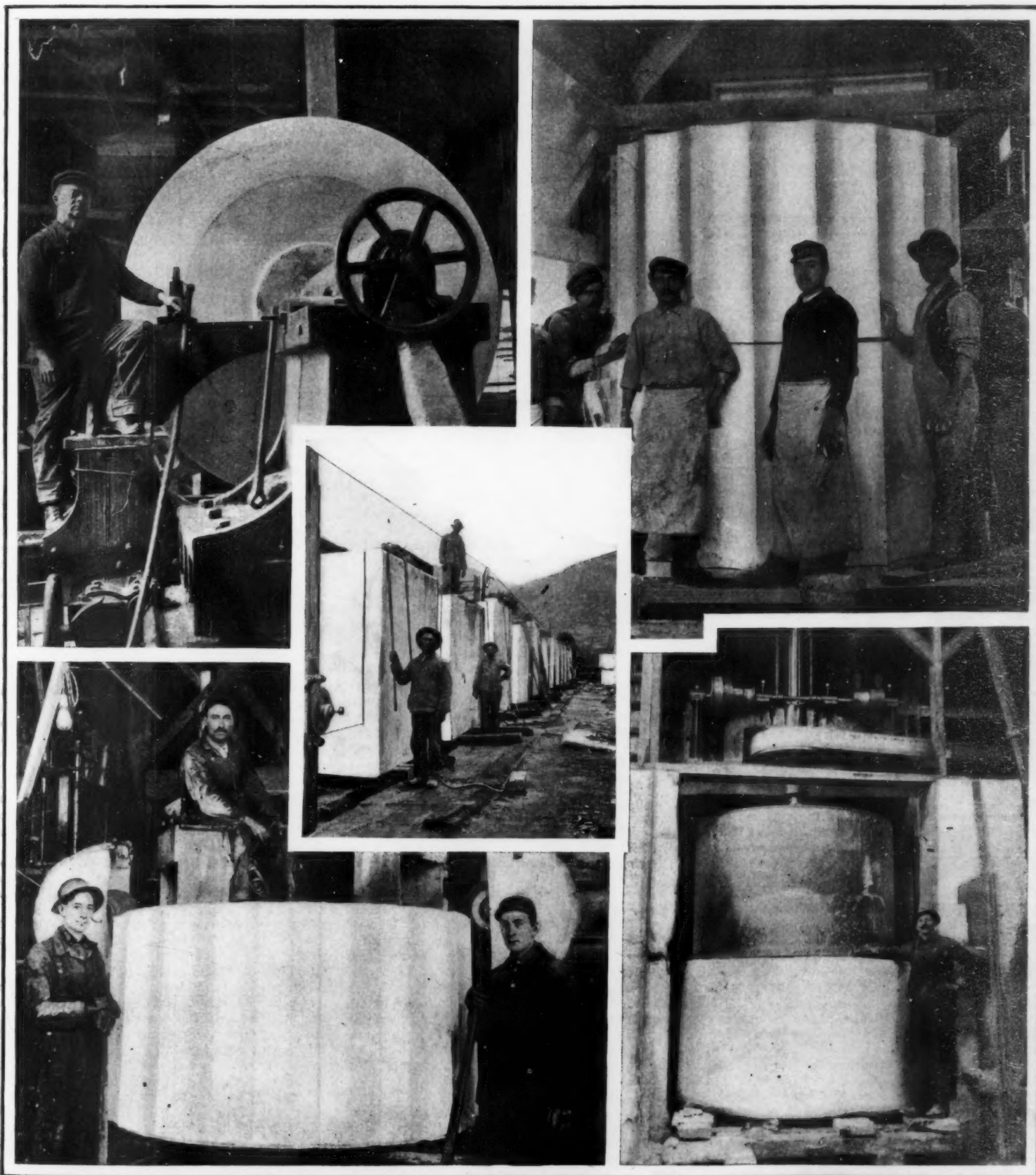
# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXII.  
NUMBER 12.]

NEW YORK, MARCH 20, 1915

[10 CENTS A COPY  
\$3.00 A YEAR



The middle picture shows 300 tons of marble being sized up with wire saws. In the lower right-hand view is a block which has been cut into a drum with the barrel saw shown above and slightly to the rear. At the upper left the drum is being turned on a lathe. At the lower left the drum is being fluted. At the upper right the drums are being finished. There are twelve of these drums to a column.

AT WORK ON THE HUGE MARBLE COLUMNS OF THE LINCOLN MEMORIAL.—[See page 267.]

## SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, MARCH 20, 1915

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary; Orson D. Munn, Treasurer, all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter Entered as Second Class Matter at the Post Office Department, Canada.

Trade Mark Registered in the United States Patent Office Copyright 1915 by Munn & Co., Inc. Illustrated articles must not be reproduced without special permission.

## Subscription Rates

|  |        |
|--|--------|
| Subscription one year  | \$5.00 |
| Postage prepaid in United States and possessions, Mexico, Cuba, and Panama |        |
| Subscriptions for Foreign Countries, one year, postage prepaid             | 4.50   |
| Subscriptions for Canada, one year, postage prepaid                        | 5.75   |

## The Scientific American Publications

|  |                  |
|--|------------------|
| Scientific American (established 1845)   | per year, \$5.00 |
| Scientific American Supplement established 1876  | " " 5.00         |
| American Homes and Gardens   | " " 5.00         |
| The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application. Remit by postal or express money order, bank draft or check |                  |

Munn &amp; Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

## The Lesson of the "Queen Elizabeth"

THE successful forcing of the Dardanelles by the Allied fleet is giving much food for thought to the ordnance officers who are responsible for our coast fortifications. When these great defensive works were planned by the Endicott Board some twenty years ago, and later revised by a board under the Taft Administration, the present realization of the controlling power of large caliber and great range had not been reached. Theoretically, these things were well understood, but the consensus of opinion—perhaps to be more correct, we should say the controlling opinion—in the Board of Ordnance of the United States Army, was in favor of using nothing larger than a 12-inch gun with a muzzle velocity of from twenty-two to twenty-five hundred feet per second.

The Endicott Board, it is true, made provision for mounting a certain number of 16-inch guns; but only one of these—a type gun—was made and tested; and so satisfied was our Ordnance Board that a 12-inch rifle of moderate velocity would prove sufficient to reach and penetrate the armor of any enemy's battleship, that the 16-inch gun, after firing a few rounds, was permitted to lie on its temporary mount at the Sandy Hook proving ground for a great many years, where it was regarded as something of a white elephant. Only recently has this powerful gun been provided with a mount and shipped to Panama, there to take its place as the most powerful gun in the canal defenses. The 12-inch coast-defense gun fires a 1,000-pound shell, with a muzzle velocity of twenty-five hundred feet per second, and its extreme range, as governed by the maximum elevation which can be given to the piece on its disappearing mount, is about thirteen thousand yards.

Some ten years ago the Board of Ordnance determined to raise the caliber of our heavy coast-defense guns from 12 inches to 14 inches. Had the velocity been maintained at the twenty-five hundred feet per second mark attained by the 12-inch gun, our fortifications would have been armed with a piece of greater range and far greater striking energy at the distant ranges than the 12-inch gun; but, unfortunately, the Chief of Ordnance determined to sacrifice the power and range of the gun to its longevity, and in the endeavor to reduce erosion he lowered the velocity of the new 14-inch gun from twenty-five hundred to twenty-two hundred feet per second—thus, at a stroke, sacrificing both the range and the energy of what otherwise would have been a very fine and thoroughly up-to-date gun.

The ranging power of our coast defense guns is seriously curtailed by the limited maximum elevation of which they are capable. With the exception of twenty-nine, which are on barbette mounts, the whole of our one hundred and thirteen 12-inch guns are mounted on the Buffington-Crozier disappearing gun carriage; and for reasons which are not quite clear to us, although we have heard that it was in order to lessen the racking effects of the recoil, these mounts permit the guns to be given the very limited maximum elevation of 10 degrees—a fatal error, for which the whole of our coast fortifications are now paying a heavy penalty in

finding themselves utterly outranged by the heavy guns of the latest foreign warships. As matters now stand, the maximum range of our 12-inch guns, with a 1,000-pound shell, is thirteen thousand yards. By a change in the carriage, increasing of the elevation to 15 degrees, and reducing the weight of the shell to 700 pounds, it would be possible to cover eighteen thousand yards, but this, of course, would involve lower penetrating power and a much smaller bursting charge in the shell.

At the time when Gen. Crozier introduced the 14-inch gun and made what seems now to have been the fatal error of reducing the velocity to twenty-two hundred feet per second, the SCIENTIFIC AMERICAN protested bitterly against a policy of sacrificing range and hitting power in order to lengthen the accuracy life of the gun. The General pointed out to the writer at that time that the lower velocity was compensated for by the greater weight of the shell, and that the hitting power of the new 14-inch was somewhat greater than that of the 12-inch high-velocity gun. We then thought, and we now think, that it was nothing less than a calamity, that when introducing the big 14-inch guns, the high velocity of the 12-inch gun was not adopted or even that the velocity was not raised to twenty-six hundred feet (which is the standard velocity for the Navy 14-inch guns); for in that case our coast fortifications, and especially the latest works of this kind, as at Panama, would be in a position, to-day, to match gun with gun and range with range against any foreign ships that are afloat on the high seas.

As a matter of fact, we learn that in the attack on the Dardanelles the latest British dreadnought, "Queen Elizabeth," reduced one of the strongest forts in the narrows of the Dardanelles from a distance of twenty-one thousand yards, or over eleven and a half miles. Had the "Queen Elizabeth" been attacking Fort Hancock at Sandy Hook, she could have taken position and steamed to and fro eight thousand yards outside the maximum range of the 1,000-pound shells of the 12-inch batteries, and proceeded to drop her 15-inch shells into the open emplacements of the rifles and even into the sunken pits of the mortar batteries.

But the "Queen Elizabeth" is not the only ship afloat that could reduce any of our coast fortifications without the slightest risk to herself; for practically all of the dreadnoughts of foreign powers could do the same thing. If the reader doubt it, we invite his attention to an article on the North Sea fight, in which we give a diagram showing the maximum range of the armor-piercing guns carried in the German fleet; and from this we learn the disconcerting and truly amazing fact that because of the high velocity and wide range of elevation of the German guns, it would have been possible, had hostilities occurred with that country, for the German armored cruisers such as the "Scharnhorst," "Gneisenau," and "Blücher," to have covered any of our coast fortifications with a rain of high explosive shells from a distance of twenty-two thousand yards, or over twelve miles. Had they used their dreadnoughts they could have done the same thing from a distance of twenty-six thousand yards, or six or seven miles beyond the maximum distance to which the guns of our coast fortifications could throw their 1,000-pound projectiles. While bombarding the forts, the ships would be hulled down at these ranges; but the aeroplanes, and observation by other ships, would make it perfectly possible in reasonably clear weather accurately to direct the bombardment.

As we said at the outset: There is food for thought in all this.

## Light Reading for Polar Explorers

AN English journal describes the library carried by Shackleton's expedition on the "Endeavor" as including thin-paper editions of seven poets, viz., Keats, Shelley, Wordsworth, Byron, Burns, Browning, and Matthew Arnold; also "A Book of Light Verse," edited by R. M. Leonard; "A Century of Parody," edited by Jerrold and Leonard, and eighty volumes of a thin-paper edition of "The World's Classics," each 6 by 4 inches, together occupying less than 4½ feet of shelf-room.

The above enumeration suggests an inquiry which some newspaper, with a penchant for eliciting votes on all sorts of questions, might find it worth while to submit to the public: What books would you take with you on a polar expedition, apart from those required in connection with the work of the expedition?

The question has, of course, presented itself to every prospective polar explorer, and it is interesting to see how variously it has been answered. It is a question of no little importance, because, on the one hand, reading is the one great resource of the polar explorer, especially during the long inactive winters, while on the other the number of books that an expedition may carry is limited by practical considerations. Drygalski, in his narrative of the German South Polar Expedition of 1901-1903, writes entertainingly of the enormous amount of reading done by the members of his party. The "Gauss" had an unusually large and varied library,

presented by German publishers and other friends of the expedition, and it was the rule that after a book had been read by one of the explorers it went the rounds of the rest, and then furnished a topic of conversation at table. The specimens of light literature were soon worn to pieces. It is interesting just now to learn that one of the favorite authors in the ship's library was Treitschke, all of whose books were devoured with avidity. Some of the party found works on philosophy most congenial, but Drygalski complains of the meditative and introspective mood resulting from such reading.

Greely records that the Lady Franklin Bay Expedition had an excellent library, embracing, besides Arctic works, encyclopedias, scientific works, etc., about a thousand novels, magazines, and other works of a light character.

In the narrative of Scott's last expedition we find many references to the books carried on the sledging expeditions. "David Copperfield," "The Life of R. L. Stevenson," and "Simon the Jester" (rather an odd assortment) were the favorites of Campbell's sledging party, while Griffith Taylor and his companions took an even more miscellaneous "sledging library" on their westward journey, including Tennyson, Browning, "The Autocrat of the Breakfast Table," a novel by William Le Queux, a number of the *Red Magazine*, and five books in German (two of them mathematical). Taylor says "as a caution to later explorers" that the magazine was easily the favorite, while "somehow we didn't hanker after German." On another sledging journey Taylor's party took Harker's "Petrology," Poe's "Tales," "Martin Chuzzlewit," "The Mysterious Island," a German grammar, and "Incomparable Belairs."

In some respects the most remarkable of "sledging libraries" of which we have any knowledge was that carried by Alfred de Quervain and his little party of Swiss on their recent dash across the Greenland ice-cap. Each explorer was allowed to take along books up to a maximum weight—necessarily very small—with the result that the library contained only the following specimens of "light literature": A volume of Schopenhauer, a "Faust," a Greek Testament, a "Zarathustra," and selections from Sophocles, Euripides, Molière, Lessing, Goethe, and Ibsen; in addition to which one of the party smuggled along a two-pound volume of Mach's "Theoretical Physics" in his instrument case. The leader records that Schopenhauer's "furious polemics" were found especially refreshing, and that in the tent, at night, whichever of the party happened to be engaged with that cheerful author found it impossible to refrain from reading aloud passages "to which the raging storm furnished a fitting accompaniment." Lessing's "Minna von Barnhelm" must, however, have been the favorite, says Quervain, "judging from the grease-spots." Through a deplorable oversight a volume of Homer (of course in the original), from which much diversion had been anticipated, was left behind on the west coast.

## Infringing Patents Are Often Valid

WE are constantly asked by patentees why the Patent Office gives them a patent which infringes another and earlier patent, and they believe that in giving them a patent under such conditions, for an invention which they find they cannot make, use and sell, the Patent Office has given them an invalid patent, or as they generally put it, "a patent that is no good." They do not seem able to understand that their own patent may be good and valid even though it does infringe a previous patent, and they cannot either make, use, or sell that for which the patent was granted them.

This matter would be clear if patentees understood the law under which patents are granted and the rights which are conferred upon them by the patent when granted.

The law requires that a patent shall be granted for a new and useful invention. Such an invention is patentable, even though it includes as a part something which is patented in a prior patent.

Now one who obtains such a patent should know that he cannot make, use or sell it, provided the prior patent is still in force, without the consent of the owner of the prior patent, for his patent or the patented thing infringes such prior patent.

We believe that much of the confusion arises from the words of the patent grant which purports to confer upon the patentee "the exclusive right to make, use and vend" his invention.

This is not what the patent secures to him, but what is given him is the right to exclude all others from making, using or vending his patented invention. This right he may enforce by his patent, even though he cannot make, use and sell it himself.

So that it follows that his patent for a new and useful invention will be given him by the Patent Office, even though it does infringe a prior patent, and also his patent may be absolutely good and valid even though he cannot make, use, or sell his own invention.



## Electricity

**Telephone Fire Alarm System.**—As an emergency precaution the Fire Department of New York city has established a telephone fire alarm system. Should there be a breakdown of the existing fire alarm system a signal will be sent out notifying the police as well as the fire companies, and at once men will be stationed at the fire alarm boxes. Then when a man runs to the nearest firebox to turn in an alarm, he will find someone stationed there who will send in the alarm over the police lines.

**Co-operative Electric Garage.**—The New York Electrical Vehicle Association has opened a new co-operative electric garage. In this venture the Association has been aided by three of the leading makers of electric pleasure cars who have made this garage their headquarters. The garage is operated by the Association and the average cost of keeping a car there is about \$45, this including care of the car, charging and boosting. The garage has a floor space of 30,000 square feet. The switchboard has 48 charging outlets.

**A Vibration Electrometer.**—Any alternating current measurement which makes use of a null method requires an instrument which will detect small alternating currents or voltages. For this purpose the telephone is used, being very sensitive between frequencies of 500 to 3,000 cycles per second. However, it is very insensitive at frequencies below 100 cycles and, also, it responds to the harmonics of the current as readily as to the fundamentals. Vibration galvanometers may be adjusted so that any harmonics in the current will produce very little effect upon the deflection of the instrument, but while such instruments are very sensitive at low frequencies, they require an appreciable current to produce a deflection because of their relatively low impedance. Hence in bridges where the impedance of the arms is very high they are not very sensitive. A vibration electrometer is described in Scientific Paper 239 recently issued by the Bureau of Standards in which the impedance is much higher than that of a telephone or vibration galvanometer. It is a modification of a quadrant electrometer. Instead of the quadrant there are four vertical plates while a thin vertical vane of twice the area of a single plate corresponds to the needle of the electrometer. Two plates separated by a narrow vertical slit are in one plane, while opposite them in a parallel plane are the other two plates. Midway between the planes is the aluminium vane suspended by a bifilar suspension. The vane is maintained at constant potential by a battery, while an alternating voltage with the same period as the natural period of the vibrating system is applied to the plates. This sets the vane in vibration and as the forces are small, the suspension is designed so that there will be very little loss of energy, and the instrument is kept in a vacuum.

**A New Rectifier.**—Dr. Saul Dushman, writing in the *General Electric Review*, describes a new rectifier of the hot cathode type which he calls *kenotron*, derived from *kenos*, the Greek for "empty" with the suffix *tron* signifying an instrument. The name gives a clue to the particular feature which has made this rectifier practical. It has been known for some time that a vacuum tube containing two electrodes, one of which is heated, will act as a rectifier. But the apparatus acts very erratically and, furthermore, as the voltage is increased there is a blue glow that grows more and more pronounced and under these conditions the cathode disintegrates, rendering the rectifier inoperative. Investigation has proved that the glow is due to positively charged gas molecules which bombard the cathode and cause its disintegration. But when the vacuum is made more perfect, there is no evidence of a gaseous discharge and conduction occurs only by means of electrons emitted from the hot cathode. As the temperature of the cathode increases the electron emission increases in accordance with a known equation, but above a certain temperature it becomes constant, and this, it has been discovered, is due to a "space charge;" that is, the electrons emitted from the hot cathode produced an electrostatic field which tends to prevent motion of any more electrons toward the anode. It has also been found that with a hot filament, in place of the ordinary cathode, there is no conduction except by electrons. Hence, in the *kenotron* a filament is used for the cathode, which may be either a straight piece forming the axis of a cylindrical cathode or a V or W-shaped filament placed between parallel plates or headlight filament inside a molybdenum cap. Up to the present *kenotrons* have been constructed for direct current voltages as high as 100,000, with every prospect of being able to increase the pressure to twice that amount, and the maximum current rectified has been as much as 1.5 amperes. The instrument should be of service in the physical laboratory where small direct currents of very high voltages are often required. It should also be useful for X-ray work and it is not impossible that it might be used for high-voltage direct current transmission. In Europe the Thury system of high voltage direct current has been found to possess many advantages. It will be quite feasible to transmit 1,000 kilowatts with 100 *kenotrons* working in parallel at 50,000 to 75,000 volts.

## Science

**The Polar Medal** has been awarded by the British government to the officers and men of Mawson's Australasian Antarctic Expedition of 1911-14. This medal was last awarded in 1913 to the members of Captain Scott's last Antarctic Expedition.

**Protecting the Elk.**—The Forest Service reports that it made two "plants" of elk last year; viz., one of twenty-four head on the Colorado Forest and one of twenty-three head on the Sopris Forest. Since the distribution of elk began three years ago, a total of about five hundred head have been planted in eleven national forests by the Forest Service, the Biological Survey, and certain States, in nearly every case with successful results.

**The Exhaustive Study of the Cacti** which Dr. Britton and Dr. Rose have been carrying out for the Carnegie Institution, and to which reference has previously been made in these columns, has now reached the point where the descriptive accounts of most of the genera and a majority of the North American species, including those of Central America and the West Indies, have been drawn up. Dr. Rose spent several months last year collecting cacti in western South America, and this year he expects to carry out a similar undertaking in eastern South America. Dr. Britton's field work last year included extensive studies in Porto Rico and adjacent islands, one interesting result of which was the recognition of the long-lost *Cactus moniliformis* of Linneus.

**The Bureau of Chemistry and the Fish Industries.**—Through its Bureau of Chemistry the U. S. Department of Agriculture proposes hereafter to devote the same attention to questions of storage, transportation, prevention of waste, and utilization of by-products in the various fish industries which has heretofore been devoted with such conspicuous results, to meat and fruit industries. It will co-operate in this undertaking with the Bureau of Fisheries. Studies of the utilization of wastes from the fisheries have hitherto been confined largely to the manufacture of fertilizers, fish oils, and glue, and have not tended to conserve the food supply. The Bureau has recently paid special attention to the industry of canning sardines on the coast of Maine, and has already brought about a marked improvement of the sanitary conditions under which these fish are packed.

**Death of Prof. James Geikie.**—The announcement is made that Prof. James Geikie, the noted geologist died in Edinburgh on March 2d. At the time of his death he was Emeritus professor of Geology and Mineralogy at the University of Edinburgh and dean of the Faculty of Science. After his graduation from the University of Edinburgh he entered Her Majesty's Geological Survey in 1861, and in 1869 he became District Surveyor. In 1882 he occupied the Murchison Chair of Geology at the university. He was one of the founders and a past president of the Royal Scottish Geographical Society, and an honorary editor of the *Scottish Geographical Magazine*. During his life he was the recipient of many honors, including the Murchison medal of the London Geographical Society, the Brisbane Medal of the Royal Society of Edinburgh and the gold medal of the Royal Scottish Geographical Society. Prof. Geikie was an extensive writer, and a contributor to many publications. Among his books may be mentioned "The Great Ice Age," which came out in 1872, and "The Antiquity of Man in Europe." Prof. Geikie was born in Edinburgh in 1839.

**Invisible Icebergs.**—In a recent communication to the New York *Tribune* Abbot H. Thayer, the artist, asserts that many vessels have been lost by collisions with icebergs because, under certain conditions of sky and light, they were invisible. He cites the fact that on the occasion of the "Titanic" disaster, although the black ship was clearly visible to survivors at a distance of several miles they could not see the white bergs against which they actually heard the wash of the sea. He claims that on a clear starry night the bergs are so nearly the same color as the sky that they are totally invisible, and that the same is the case under many conditions of cloudiness, the only exception being when the side of the berg viewed is in such shadow that it shows black against the sky. In other words, it is impossible to see white against white. We do not see white against black, as is the general impression of the conditions that prevail in the case of icebergs at night. As an experiment he suggests that we view the snow covered roofs of neighboring houses at night, far enough away from artificial lights so that the sky is not affected by them. He asserts that it will be impossible to distinguish the white, snowy roofs, which correspond in color with the iceberg, from the sky. The same result is found when the roofs are observed in broad daylight on a cloudy day whenever the light is uniform. In answer to the criticism of those who say they never saw a berg at night that was the color of the sky the answer is made that this is very natural, because this is the very condition under which the berg is invisible. Mr. Thayer makes the suggestion that a very simple way to avoid the danger of colliding with an invisible berg would be to use a searchlight; the reflection would show up the berg very plainly.

## Automobile

**Armored Automobiles.**—The \$50,000 included in this year's army appropriation bill for the purchase of armored cars stimulates inventive manufacturing interests since the development of a satisfactory automobile of this type should lead to large appropriations here as well as to orders from abroad. Capt. John B. Ross, U.S.A., of the Ordnance Branch of the service, is under orders to inspect at Detroit a car built at the plant of one of the large producing companies following the ideas of one of the company's inventors.

**Good Roads Mileage in France and America.**—According to the Good Roads Year Book of the American Highway Association, recently issued, America now has 6,000 miles of more good roads than France, the total for this country now amounting to 31,000 miles. Of this 5,000 miles were built in 1912 and about 6,000 in 1914, making a total of over one third of the entire mileage of the good roads of the country. New Jersey was the pioneer State to provide State aid for public highways in 1891 and Massachusetts and Connecticut soon followed, but it is only during the last 10 years that the State aid policy has been in effect to any considerable extent.

**A New Tell-tale Spark Plug.**—A novel type of spark plug for internal combustion engines has been invented by a British company. The plug has a tubular central electrode, which carries a block of quartz serving the purpose of a window through which one can observe the "color" of the explosion in the combustion chamber. A dark purple spark shows the mixture to be correct; a light blue or white explosion signifies that it is too weak, while a red color indicates too rich a mixture. By simply detaching the quartz "window" and substituting a milled nut, the plug is transformed into a "priming" plug, through which gasoline can be injected directly into the combustion chamber.

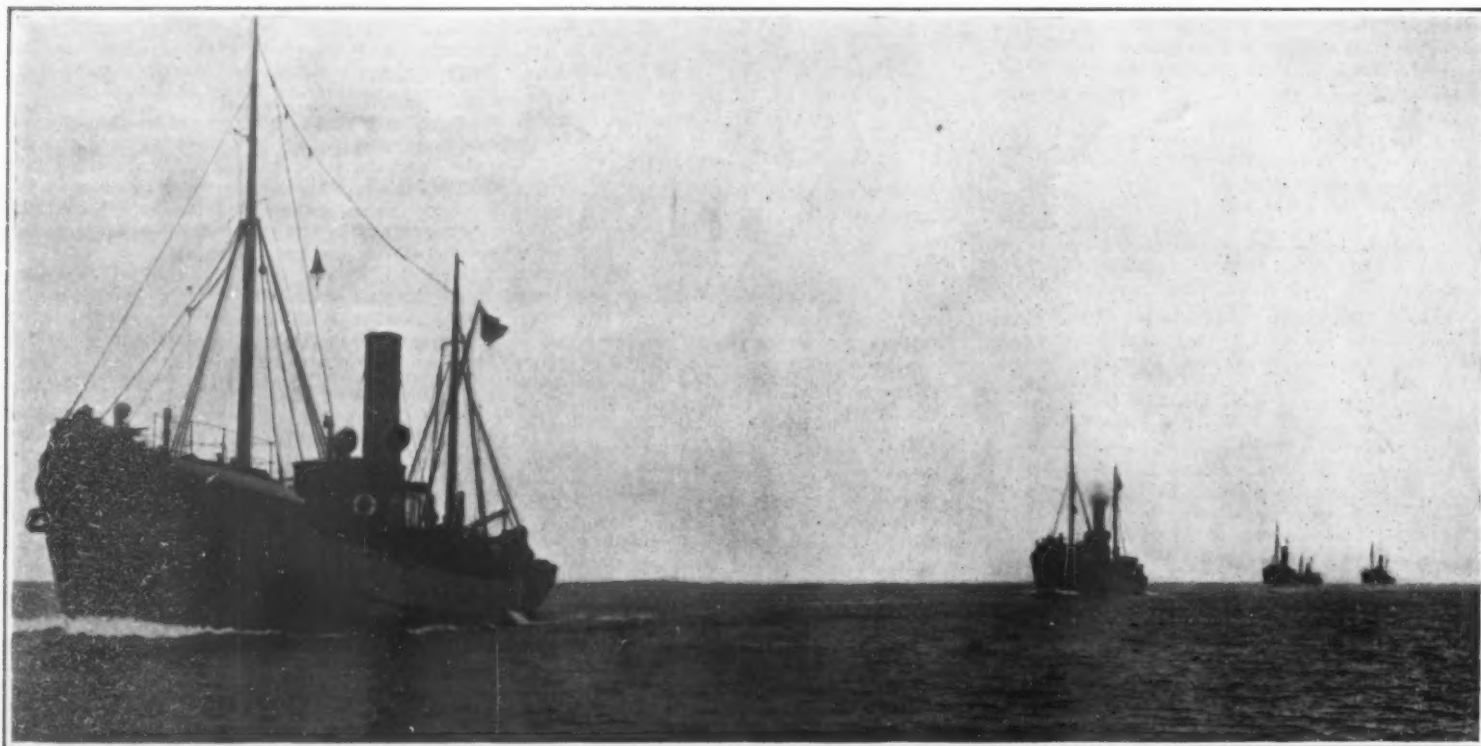
**A Reversible Spark Plug.**—A spark plug which permits the driver to watch explosions through a mica window, is not new. But the manner in which the reversible "twin-spark" plug accomplishes this object is decidedly novel. The plug really consists of two separate and distinct plugs assembled into a single unit. While the "active" end is screwed into the cylinder heads, the outside end also gives off sparks, which are easily watched from the seat, when the hood is raised. If the end of the plug used for exploding the gas mixture becomes fouled for one reason or another, it is necessary only to reverse the plug and to use the other end. The fouled end can be cut out instantly by reversing the terminal contact clip, causing it to touch the plug at the central metallic groove, thereby "short-circuiting" the fouled sparking points. The double spark is said to give a very much better combustion and to enable the motorist to use a leaner mixture in the cylinders.

**Facts Reported in the Good Roads Year Book for 1915.**—More than two hundred million dollars of State appropriations have been expended to January 1st, 1915, and an approximate total of 31,000 miles of surfaced highways constructed under State Supervision since the inauguration of the policy known as "State Aid," according to the Good Roads Year Book for 1915 to be issued in March by the American Highway Association from its Washington office. Only seven States, namely, Florida, Georgia, Indiana, Mississippi, South Carolina, Tennessee and Texas, have no form of State Highway Department whatever, although Georgia grants aid to the counties for road improvement by lending the services of the entire male State convict force. To have State highway departments placed under non-partisan, efficient control; skilled supervision required in all construction work; a proper classification of highways to insure intelligent distribution of improvements; an adequate provision for maintenance of highways from the day of their completion are among the objects for which the American Highway Association is waging a vigorous campaign.

**An Automobile for Railway Use.**—In furtherance of the "safety first" principle, the Atchison, Topeka & Santa Fe Railway Company has equipped its Safety Commissioner, Isaiah Hale, with a 7-passenger automobile so fitted with removable tires as to permit of the machine being run on the standard-gauge track of the system. With him in the automobile Mr. Hale carries a phonograph and he operates the car over those stretches of the road in the far southwest where great numbers of the Mexican section-hands, track-laborers and other employees are regaled with a programme of phonographic selections. In this the Spanish tango and Mexican song records predominate. Thus the swarthy men from across the frontier are prepared for the 9-minute "safety talk" in Spanish—the Spanish of the border—which closes the impromptu "concert." This consists of a graphic recital of the disaster which must attend the taking of chances on and about the company's lines and property. Whenever he finds that the Mexican "boys" have a phonograph in their bunk cars, Mr. Hale leaves a set of "tango" and song records, which is sure to include one of the "safety-talks."

## Forcing the Dardanelles

Further Evidence of the Supreme Importance of the Command of the Sea



A fleet of British trawlers of the kind now being used by the Allies in mine-sweeping operations in the Dardanelles.

IF the great Mahan were living to-day he would witness, in the so far successful forcing of the Dardanelles by the allied fleet, one more of those striking evidences of the decisive value of the command of the sea, of which the present war has afforded so many.

It is quite possible that the ultimate issue of the great conflict will be determined by economic exhaustion, due to the absolute blockade of Germany and Austria by sea and land; and the stupendous operations which are being carried on in the Dardanelles may prove to be the forging of the last link in an unbreakable chain, which, with the capture of Constantinople and the resultant entry of Italy and the Balkans into the war, will extend unbroken from the western coast of Norway by way of the North Sea, the Mediterranean, the Balkans and Russia, to the eastern shores of the Baltic.

Much has been said and written during the past few years about the impregnable character of modern sea-coast fortifications against successful attack by water. For reasons which we indicated in our last issue, such as the more accurate range-finding and the more stable platforms of sea-coast guns, it has been generally believed that no admiral would risk the loss of ships costing from ten to fifteen million dollars apiece, by venturing within the zone of fire of heavy sea-coast guns and mortars. Nevertheless, to-day we see this very thing being done with a deliberation and a success which are equally astounding.

The security of Constantinople from attack by the sea was supposed to lie in the fact that it could be approached from the Mediterranean or from the Black Sea only through a narrow strait, at one point less than a mile in width, which was defended by some of the strongest and most heavily-armed fortifications in the world. Thus, the Dardanelles, some forty miles in length, are flanked at their entrance by forts on either side, and at the Narrows are similarly protected by a

string of forts well supplied with Krupp artillery of from 9.4-inch caliber up to 14-inch. Should both the entrance and the narrows be forced the ships for the next twenty-five miles would be threatened by various redoubts and batteries and, finally, would have to overcome a series of unusually strong defenses where the Dardanelles narrow before opening into the Sea of Marmora.

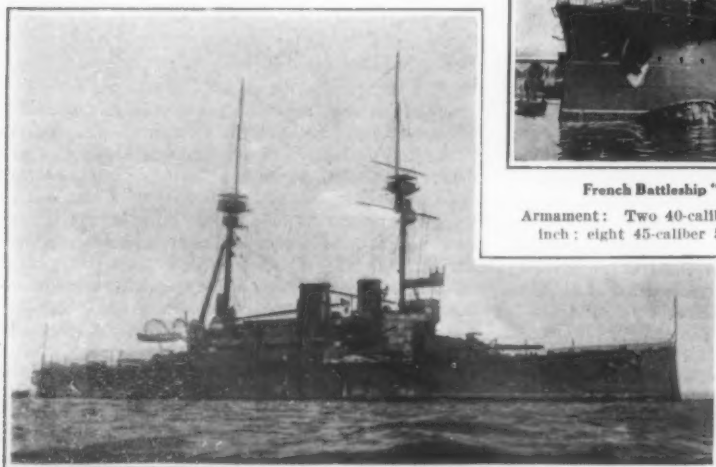
During the first two weeks of operations the allied fleet has forced the westerly entrance of the Dardanelles and silenced some of the heaviest forts at the Narrows. The indications are that this attack will be pushed through successfully. If so, the day when Constantinople will be covered by the guns of the enemy is not very far distant. Now, with Constantinople in the hands of the enemy, the whole Turkish plan of campaign would collapse; for Constantinople is to Turkey what Essen and Westphalia are to Germany. If Holland should enter the war, and the Allies, attacking on the flank, should capture Essen and the great manufacturing centers of Westphalia—the source of the enormous supply of arms, ammunition, and transport for the German army—German resistance would cease automatically. Equally vital is Constantinople, where is situated the Turkish arsenal, to the continuance of Turkish operations.

The collapse of Turkey would set free probably between 300,000 and 400,000 British and Russian troops, for the reinforcement of the allied armies in the east.



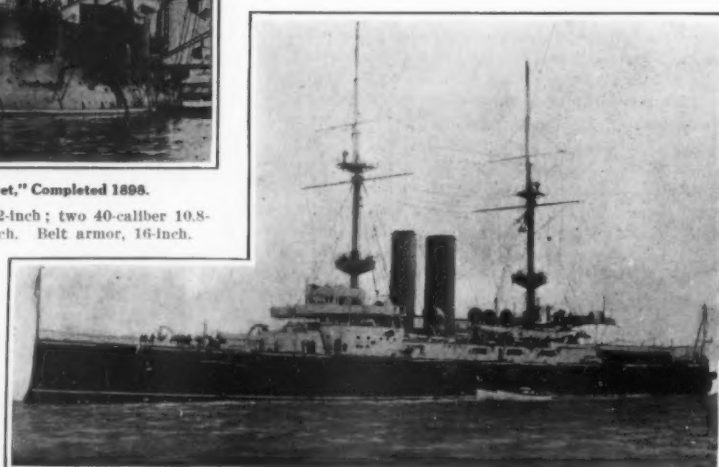
French Battleship "Bouvet," Completed 1898.

Armament: Two 40-caliber 12-inch; two 40-caliber 10.8-inch; eight 45-caliber 5.5-inch. Belt armor, 16-inch.



British Semi-dreadnought "Lord Nelson," Completed 1903. Also "Agamemnon."

Armament: Four 45-caliber 12-inch; ten 50-caliber 9.2-inch. Belt armor: 12-inch.



British Battleship "Albion," Completed 1902. Also "Vengeance."

Armament: Four 35-caliber 12-inch; twelve 40-caliber 6-inch. Belt armor: 6-inch.

The large fleet of warships attacking the Dardanelles is composed chiefly of old battleships, such as the "Bouvet" and "Albion;" the "Queen Elizabeth," "Lord Nelson" and "Agamemnon" are modern.



ern and western theaters of conflict. Furthermore, it might well serve to bring Italy and the Balkan nations into the conflict, urged on by their desire to have an authoritative voice in the readjustment of boundaries which must necessarily take place at the finish of the war.

To follow in detail the nature of the operations which are being carried out by the allied fleet we must understand the nature of the defenses which have to be broken down. These are three-fold: First, the heavy, long-range, armor-piercing guns, generally mounted on high elevations; second, the batteries of rapid-fire guns emplaced nearer sea level and the shore, which protect the mine fields and prevent mine-sweeping operations; and, lastly, the mine fields themselves.

The heavy batteries of the forts at the Narrows are armed with guns of from 9.2 up to 14-inch caliber; and the first step was to reduce these guns, if possible at a distance which would place the ships outside of the range of the forts. For this work the British Admiralty designated the most powerful ship of the British navy, the "Queen Elizabeth," which has just been commissioned. This vessel mounts eight 15-inch guns, which fire a 1,925-pound, high-explosive shell with a velocity of 2,500 feet per second. For the purpose of attack, the ship took station off the north coast of the Gallipoli Peninsula near the Gulf of Saros. Between her and the forts, running down the peninsula, was a ridge

and enable the latter to be drawn aside from the channel, or brought to the surface and rendered harmless by exploding them. Into the channel as thus cleared the fleet moves up, and the process of the reduction of the next fort or series of forts within range is proceeded with.

So interesting is the Admiralty statement of March 8th, giving the details of operations to that date, including the activities of the fleet of seaplanes, that we reproduce it in full:

"The operations at the Dardanelles are progressing and have been favored by fine weather. Admiral Carden reports that on March 6th the 'Queen Elizabeth,' supported by the 'Agamemnon' and the 'Ocean,' began an attack on Forts Hamidieh-Tabia No. 1 and Hamidieh-Tabia No. 3, marked on the Admiralty map as Forts U and V, by indirect fire across the Gallipoli Peninsula at a range of 21,000 yards, or about eleven and a half miles.

"These forts are armed thus: U with two 14-inch guns and seven 9.2-inch guns; V with two 14-inch guns, one 9.4-inch gun, one 8.2-inch, and four 5.9-inch.

#### Battleships Are Struck.

"The 'Queen Elizabeth' was replied to with howitzers and field guns. Three shells from the field guns struck her without causing any damage. Meanwhile inside the strait the 'Vengeance,' 'Albion,' 'Majestic,' and 'Prince George' and the French battleship 'Suffren' fired on the fort at Suan Dere, on the European side, and on the batteries at Mount Dardanus marked F and E on the Admiralty map.

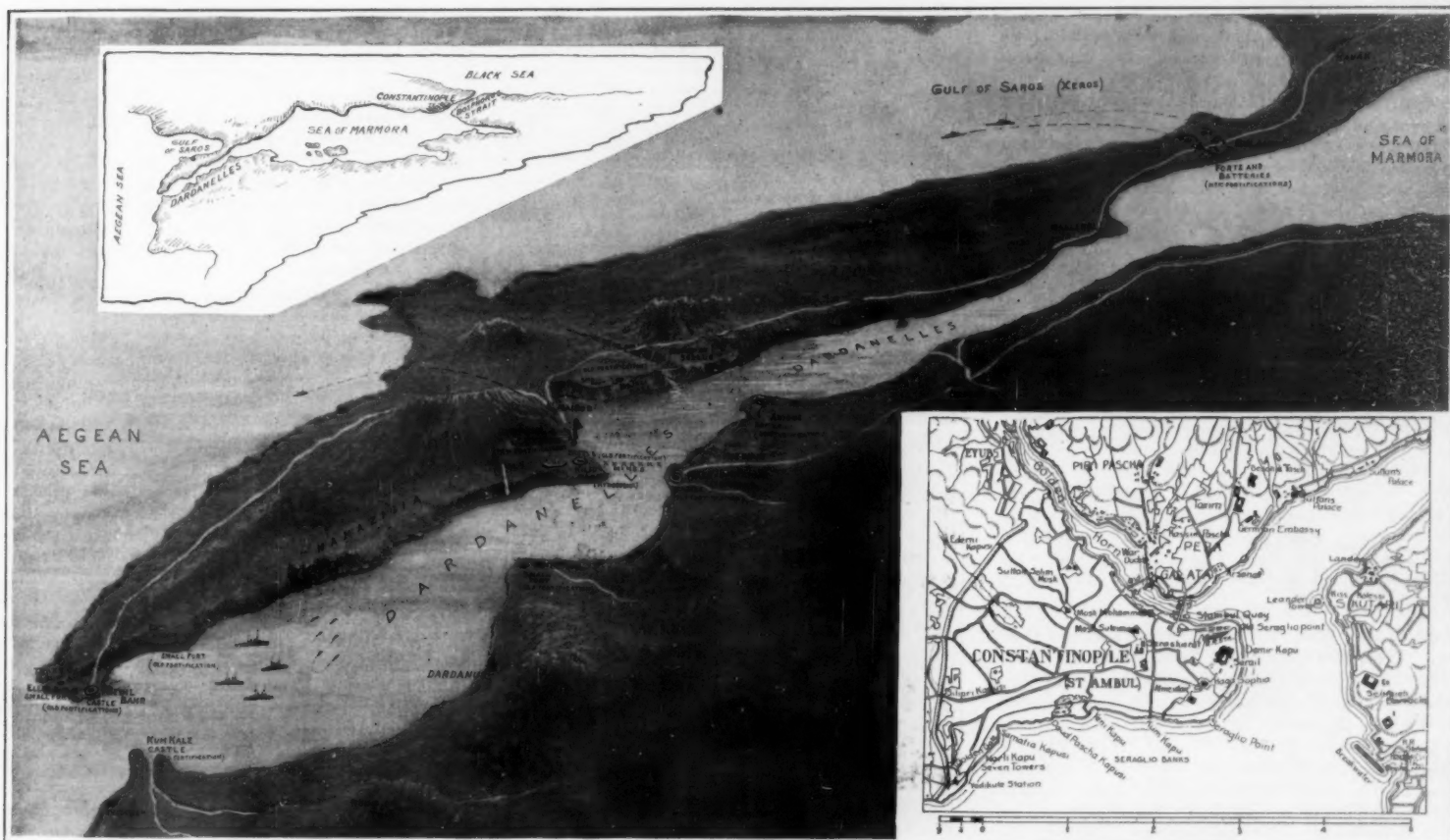
"These ships within the strait were fired on by a number of concealed guns. Fort Humil Medjidieh-Tabia, marked J on the Admiralty map, which had been attacked on the previ-

being the crew, was hit eight times in locating concealed positions.

"The 'Ark Royal,' convoy to the aeroplanes and seaplanes, is equipped with every appliance for necessary repairs and for maintenance of the numerous aircraft she carries."

We close this article with the following detailed description of the defenses of the Dardanelles and Constantinople, which is translated from the *Handbuch fuer Heer und Flotte*: The Strait of the Dardanelles connecting the Aegean Sea with the Sea of Marmora is about 70 kilometers long, with an average width of 4 to 5 kilometers. At the western entrance the width is 4 kilometers, at the narrowest portion between Kalid-Bahr and Kale-Sultanije (Tschanak Narrows) only 1,300 meters wide. The European shore is cliff-like in formation, with the exception of the mouths of small streams, and is topped by 200 to 300-meter hills. Large war vessels can easily pass through the straits, but the strong current from the Marmora Sea renders navigation somewhat difficult. The current flows with the velocity of about one and one half nautical miles an hour, but the velocity may attain a maximum of five nautical miles in a strong northern gale.

The fortifications consist of the four Dardanelles castles. Of these, the Sedil-Bahr and Kale-Sultanije were built in 1462 by Sultan Mohammed II; Kum-Kale and Kilid-Bahr, the so-called new Dardanelles castles, were built in 1659 by the Grand Vizier Achmed Köprülü. These are huge masonry structures which have been



The Dardanelles, showing the method of reducing the forts at the Narrows by indirect fire across the Gallipoli Peninsula, assisted by the observation of ships near the entrance to the strait.

Plan of Constantinople, showing the formidable character of its defenses.

of hills several hundred feet in height, which of course, shut out the forts from view. The firing was what is known as indirect—that is to say, the gunners could not see the target—and the range, according to the British Admiralty report, was about 11½ miles. The fall of the shell was noted by aeroplanes and by ships at the entrance to the strait and the proper correction was sent to the "Queen Elizabeth" by wireless.

When the heavy guns had been silenced, two semi-dreadnoughts, the "Agamemnon" and the "Lord Nelson," supported by the French battleships "Gaulois," "Charlemagne," "Bouvet," and "Suffren," engaged the forts in the Narrows at from 12,000 to 14,000 yards by direct fire; that is to say, the gunners were able to lay the gun sights directly on the forts.

Following the reduction of the heavy guns, the armored ships were sent in to closer range, where they demolished the rapid-fire batteries of 4, 4.7, and 5.9-inch guns as the case might be, which were mounted so as to cover the mine fields and prevent countermining.

For the work of clearing out the mines the British Admiralty, if we may judge from the dispatches, has sent out with the fleet several of those North Sea steam trawlers of which we have heard so much during the present war, a photograph of a few of which is herewith presented. These vessels, in pairs, drag over the course of the channel to be cleared of mines a series of heavy chains, which engage the anchorage cables of the mines

ous day, also opened fire and was engaged and hit by 12-inch shells. The majority of the ships within the strait were struck by shells, but no serious damage was done, and there were no casualties.

"The weather continuing calm and fine on March 7th, four French battleships, the 'Gaulois,' 'Charlemagne,' 'Bouvet,' and 'Suffren,' entered the strait to cover a direct bombardment of the defenses on the Narrows by the battleships 'Agamemnon' and 'Lord Nelson.' The French ships engaged the battery on Mount Dardanus and various concealed guns, silencing the fort at Mount Dardanus. The 'Agamemnon' and the 'Lord Nelson' then advanced and engaged the Narrows forts at from 12,000 to 14,000 yards by direct fire.

"Forts J and U replied and both were silenced after a heavy bombardment. Explosions occurred in both forts. Fort L has not fired a shot since the explosion of the magazine on March 5th.

"The 'Gaulois,' the 'Agamemnon,' and the 'Lord Nelson' were each hit three times by Turkish shells, but the damage was not serious. Three men were slightly wounded on the 'Lord Nelson.'

#### Aviators Wounded.

"While these operations were in progress the 'Dublin' continued to attack the Bulair Isthmus. She was fired at by 4-inch guns and was struck three or four times.

"Owing to the importance of locating concealed guns the seaplanes sometimes had to fly very low. One seaplane, whose pilot was Lieut. Garnett and whose observer was Lieut. Commander Williamson, became unstable on March 4th and dived nose on into the sea. Both officers were injured.

"Lieut. Douglas, reconnoitering at close quarters in another seaplane, was wounded, but managed to return safely. Seaplane No. 172, commanded by Flight Lieut. Bromat, with Lieut. Brown as observer, was hit twenty-eight times. Seaplane No. 7, Flight Lieut. Kershaw and Petty Officer Merchant

subject to considerable reconstruction. They are armed with old heavy guns and are partly in ruin. In addition to these there are a few small old forts.

The newer fortifications, batteries, or forts in the Tschanak Narrows were built at the instance of England between 1864 and 1877. They consist of the Namazligia group (three earth batteries southwest of Kilid-Bahr), Dzirmen-Bruus (an earthen battery) on the European side, and Medjidije (a fort) and Nagara (an old stone fort, a newer fort of earth, and two batteries) on the Asiatic side. These works have been armed for the most part with more or less modern Krupp guns and were amplified in 1886 by smaller works. In 1892 the system of obstructions were strengthened with 150 sea mines. The defenses have in recent years been somewhat modernized and provided such modern equipments as telegraph, telephone, etc. The entire fortifications are said to contain 682 guns, about one half of which are more or less modern. The modern defenses are very well equipped and manned, so that a passage could be forced only with heavy sacrifices.

As part of the Dardanelles defenses, the line at Bulair must be mentioned. This is a land defense in the north of the peninsula, 5 kilometers long, consisting of three forts each with twelve to fifteen guns, and connecting lines, intermediate batteries, and advanced redoubts (together over one hundred guns). This line of Bulair protects the mainland from attack.

## Two Startling Discoveries in Oil Refining

Dr. Rittman's "Cracking" Process in Which Vapors Are Subjected to High Pressure and Dr. Snelling's Discovery of a Way to Reconvert Paraffin, Vaseline or Any Other Petroleum Derivative into a Synthetic Crude Oil Similar to That from Which it Was Originally Obtained

### Gasoline from "Synthetic" Crude Oil\*

By Walter O. Snelling

MORE than five years ago I placed a small quantity of a transparent yellow lubricating oil in a bomb-like vessel and heated it to a relatively high temperature. At the end of the experiment I removed the oil from the vessel and was amazed to find that instead of bearing any resemblance to the oil which I put in, it now had the appearance of ordinary crude oil. The green color by reflected light and the rich red-brown by transmitted light were unmistakable. I subjected the material to fractional distillation, and the surprise which I experienced at the appearance of the oil, changed to amazement when I found that it yielded, on distillation, 15 per cent of gasoline and 30 per cent of burning oil, and that its construction resembled crude oil quite as much as did its appearance. Furthermore, the gasoline and kerosene distillates which it yielded were of a clear water-white color, entirely without treatment with acid or alkali, and were entirely free from the odor familiar in "cracked" petroleum distillates.

Apparently some remarkable change must come about in the hydrocarbon molecules, when a hydrocarbon body is heated in a still only approximately one fourth full of oil, that does not occur when the same hydrocarbon is heated under similar conditions, except that a greater proportion of the volume of the still or retort is filled with oil. With grave doubts and fears, I placed in my retort some kerosene. If this water-white material, after treatment, should come out green in color by reflected light, and red by transmitted light, then indeed I would be convinced that I was dealing with a true transformation into crude oil. The experiment ended, I poured out from the vessel a liquid which resembled Pennsylvania crude oil so perfectly that when I placed a bottle of the new product by the side of a bottle of the real crude, it was hardly possible to say which was which, by appearance alone. I next melted some paraffin and placed it in the vessel, and after heating under the prescribed conditions, I poured out a thin fluid, suggesting crude oil in every way, which on distillation gave somewhat over 15 per cent of a water-white gasoline, free from "cracked" odor, and other distillates in about the same relationship as in ordinary crude oil.

### Vaseline, Rod Wax, All Natural Hydrocarbons Yield Gasoline Containing Synthetic Oil.

One after another I tried putting all natural hydrocarbons available to me through this process. Vaseline, rod wax, gas oil, fuel oil, and B. S., all these went into my treating vessel, one after the other. They all yielded materials similar in appearance, odor, and composition. From any of these materials I obtained a synthetic crude oil containing around 15 per cent of gasoline, and other distillates in about the same order as are found in typical crude oils.

This paper makes public for the first time the results of my experiments, and in presenting it I wish to express my indebtedness to Mr. John T. Milliken of St. Louis, Mo., president of the Milliken Refining Company. He was the first oil man whom I met, who was willing to believe that research could really add materially to the oil man's knowledge. He has generously supported the experiments which I am now reporting.

It has long been known that under the influence of high temperature hydrocarbon bodies could be thermolyzed or "cracked," and that by this method low boiling bodies could be produced from hydrocarbons of higher gravity. Indeed, the commercial use of cracking distillation in petroleum refining goes back from more than half a century.

### "Cracking" and the Snelling Process Compared.

When the limitations of simple cracking of hydrocarbon oils at ordinary pressures were first understood, efforts were made to bring about destructive distillation under increased pressure. Results showing great improvement over those obtained by the simple cracking methods were given by these processes, which seem to have been first made use of by J. Young, and later developed by Dewar and Redwood, and others. Very recently improved processes of cracking distillation under increased pressures have been used commercially by Burton, and are said to have been so developed as

Two very remarkable processes for producing gasoline have recently attracted the attention of the entire country—the one devised by Dr. Walter F. Rittman and the other by Dr. Walter O. Snelling. Both are still in the laboratory stage, and much research of a most expensive and extensive character must be conducted before they can be considered commercial successes. The SCIENTIFIC AMERICAN here publishes the first exposition of the principle underlying both processes. Mr. Claudy's article appears with the approval of Dr. Rittman, to whom it was submitted before publication, and Dr. Snelling's is an abstract of an unpublished paper read recently before the American Institute of Mining Engineers. After reading the two articles, we cannot but be impressed with the mystery of crude oil. Here is a compound with atoms and molecules so delicately balanced that they can be shifted into new relations merely by changing the pressures to which they are subjected or by changing the volumes employed. Why this should be so no chemist is wise enough to answer. In other words, there is still more empiricism than science answers in petroleum refining. While both discoveries are related to "cracking," Dr. Snelling's is particularly noteworthy in the sense that he can take what may be called a finished product and rearrange its structure so that it becomes practically its own original.—EDITOR.



Dr. Walter O. Snelling, who has succeeded in making gasoline from synthetic crude oil.

to yield products readily salable as substitutes for gasoline.

It will thus be seen that I cannot claim to be in any way a pioneer in the production of lighter hydrocarbons from materials of heavier gravity. Hydrocarbons have been cracked and broken up into lighter hydrocarbons of lower boiling point, both experimentally and commercially, for a period of over fifty years, and such cracking experiments have been conducted both at normal pressures and under increased pressures.

Apparently, however, the remarkable influence which is played by the ratio of the liquid contents of the vessel to the total volume of the vessel, has been either wholly overlooked, or at least not properly appreciated. It has been wholly through the investigation of the effects of the ratio of the volume of oil, to the total volume of the vessel, that I have developed the process which I am here describing, and which has given the remarkable and unexpected results already mentioned. I believe it is only when these suitable volume relationships are observed that we can get these results within a range of temperature and pressure adapted to commercial development.

### The Wonderful Results are Obtained Only When Small Quantities are Treated.

Very careful studies made in my laboratory have now proven that, when a hydrocarbon body, such as gas oil, for example, is heated in a vessel which is filled to

more than one tenth of its volume with such oil, but such filling is less than one half of the total volume of such vessel, and if then the vessel is so heated that a pressure of say 800 pounds per square inch exists within the vessel, a very remarkable and fundamental change occurs in the hydrocarbon filling such vessel. It is as though the carbon and hydrogen atoms were free to rearrange themselves, and that such rearrangement goes on until a more or less definite mixture of hydrocarbons remains in the vessel. Where the vessel is less than one tenth filled with oil, considerable "cracking" seems to take place and the product is quite inferior. Where the vessel is much more than one half filled with oil, the reaction seems to fail almost wholly, the amount of light products produced being very small. But when the conditions within the vessel, as to amount of filling and temperature applied, are as indicated above, the carbon and hydrogen atoms of the hydrocarbon seem to rearrange themselves to form crude oil and natural gas.

In this rearrangement, not only are low boiling compounds produced from those of higher boiling point, but even the reverse action takes place. In several tests I have obtained from petroleum products of medium boiling point synthetic crude oils which contained high-boiling ends, whose boiling point was considerably higher than any of the constituents present in the original oil used. Apparently the entire process depends upon certain equilibrium reactions, in which constituents of different boiling point tend to be present in a certain very definite ratio, provided the space relationship within the treating vessel is of the proper order. Solid paraffin, of course, contains no constituents that are liquid or gaseous at ordinary temperatures, but upon treatment by this process even this solid paraffin is resolved into synthetic crude oil and natural gas, and the percentage of products of each definite boiling point appears to be in a definite condition of equilibrium. If, instead of starting with paraffin, we go to the other extreme, and start with kerosene, which is entirely free from heavy ends, we will obtain a synthetic crude oil which is much lighter in gravity than that produced from paraffin, but which nevertheless contains high boiling constituents whose boiling point exceeds by many degrees the boiling point of the heaviest product present in the untreated kerosene. Thus, it will be seen that while this process is primarily one in which heavy hydrocarbons give crude oils containing light distillates (this being the main trend of the reaction), yet the process is so essentially one dependent upon equilibrium, that if high boiling constituents are absent, or present in very small amount, the equilibrium will not be satisfied until additional amounts of these high boiling constituents have been produced as the result of the reaction which is going on.

### Gasoline is Always Contained in the Synthetic Oil.

A residual pressure, after cooling, always exists due to the natural gas formed in the process, and the amount of gasoline in the synthetic crude oil seems to be very constant no matter what hydrocarbon is taken. If is of course evident to the chemist that natural gas and gasoline contain a greater percentage of hydrogen than do heavier oils, and it is very interesting to note that when the charge which is placed within my treating vessel contains a hydrocarbon deficient in hydrogen, the formation of saturated gasoline goes on just the same, and the synthetic crude oil produced carries a "mud" consisting of the carbon which in the rearrangement has failed to find hydrogen. The gasoline produced from materials even highly deficient in hydrogen is quite normal in color and does not appear to be in any way like the "cracked" products which are produced by the thermolysis of oil vapors, etc.

It is of course evident that if putting any hydrocarbon through the process described makes it into a crude oil, it ought to be possible to take any hydrocarbon, and first convert it into crude oil by the process described, then remove the gasoline, for example, or any other constituent, from this crude oil by distillation, and then to subject the residue to a repetition of the process. I have done this many times, and have converted paraffin and other petroleum products almost wholly into gasoline and natural gas. I have obtained from paraffin about 70 per cent of water-white gasoline, the remaining 30 per cent representing the natural gas formed by the repeated action of the process, and some free carbon. From fuel oil, gas oil, vaseline, and similar materials I have obtained from 50 per cent to 70 per cent of water-white gasoline, and samples of

\* Paper read before the American Institute of Mining Engineers.



this gasoline, even after standing for a year or two, do not discolor, nor acquire an offensive or "cracked" odor. I wish particularly to note that this gasoline, even when produced, was not treated in any way, and has never come in contact with either acid, alkali, fuller's earth, bone black, or other related materials. In brief, the process which I have described produced from practically any hydrocarbon a material which resembles natural crude oil, and which gives a gasoline which appears equal in quality and appearance to gasoline from natural crude. Both the crude oil produced by my process and the gasoline produced from its distillation possess an odor which is somewhat different from the odor of natural crude oil and ordinary gasoline. This odor, while peculiar and distinctive, is not in the slightest like the odor of "cracked" products, and it is in fact a slightly milder and sweeter odor than that of ordinary oil products. Upon mixing my synthetic crude oil, or the gasoline produced from it, with certain muds and clays, it seems to be altered, and the odor changes and becomes much more like that due to ordinary crude oil.

These experiments which I have described have been wholly of a laboratory nature, and much work remains to be done in the application of the principles which have been discovered, to commercial work on a large scale.

### The Rittman Process of "Cracking"

By C. H. Claudy

THE shortage in dyestuffs founded upon the coal tar industry, as well as the increased consumption of gasoline abroad, not to mention the enormous business in explosives, have all aroused great interest in possible methods of supplying coal tar dyes, gasoline in enlarged quantities, and explosives of all kinds. In many explosives coal tar products are important ingredients. Any process, therefore, which is concerned with coal tar or gasoline, and looks to the preparation of either, is of considerable economic interest in America. A process which concerns both coal tar derivatives and gasoline is, therefore, of double interest. But the ill-considered and misleading statements of newspapers regarding new processes and their possibilities frequently do more harm than good, by prejudicing the scientific world in advance against worthy ideas, when they are presented in a manner which shows at once that impossible claims are being made.

The recent announcement by the Secretary of the Interior of a new process of petroleum "cracking" has resulted in the usual daily press hysteria regarding its possibilities. While refusing to prophesy what the future will develop in the commercial application of his discoveries, Dr. Walter F. Rittman, chemical engineer of the Bureau of Mines, would be the first to decry the many impossible powers attributed to his results by newspapers more sensational than accurate.

#### Dr. Rittman's Process is Still in the Laboratory Stage.

Dr. Rittman's processes, which are the result of applications of mathematics, physics, and chemistry to the process of petroleum cracking, were worked out in the laboratories of Columbia University. Showing remarkable results in many ways, they are still in the laboratory stage, and, as all practical chemists know, what happens in the laboratory cannot always be duplicated commercially on a large scale. Dr. Rittman believes that his process is commercially practical, and that it will not only result in an increased production of gasoline at a less cost than at present, but that it will to a large extent relieve the shortage in coal tar dyes caused by the European situation, and in the same way, contribute to the manufacture of those explosives which depend upon coal tar derivatives for their ingredients. That a full-fledged coal tar industry, completely displacing foreign competition, will result from the application of this process commercially, as apparently believed in some newspapers, is an absurdity at which Dr. Rittman would be the first to laugh.

The fundamental difference between the Rittman process and all other processes of obtaining from petroleum those more refined products of use in the arts, is found in its use of the vapor phase rather than the liquid phase of the material which is to be "cracked."

#### The Old and the New Process of "Cracking."

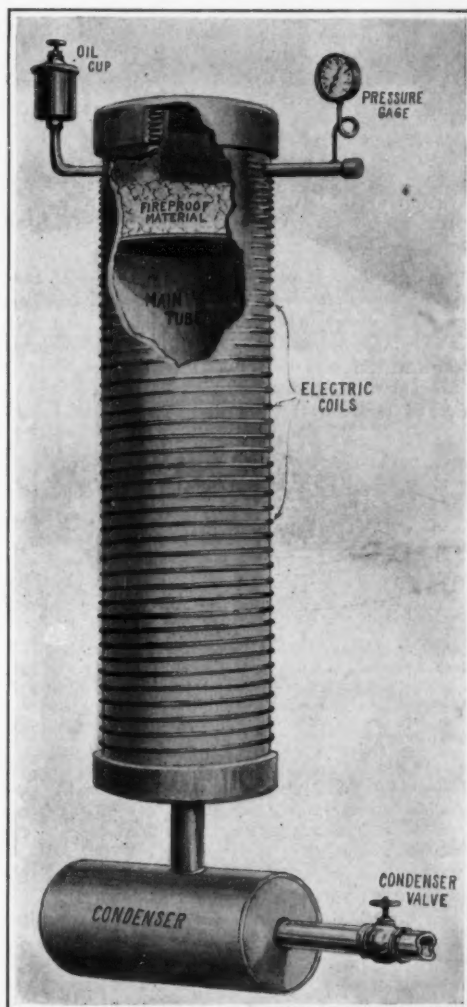
From the beginning, the still has been the recognized method of dealing with any treatment of petroleum. When distillation gave rise to the newer process of "cracking" a heavy petroleum distillate to make lighter oils, the use of the still was continued. A certain inertia apparently developed in the chemical engineer's mind which prevented him from thinking of any process looking to the refinement or change of petroleum constituents which did not involve a process of distillation.

The immediate result has been to limit the "cracking" process to the pressures and temperatures which were practical and profitable from the commercial standpoint in the still.

Dr. Rittman attacks the problem from altogether an-

other angle. Knowing that liquids are incompressible, and that, in spite of the application of considerable pressure, they do boil and thus give rise to danger of exploding the still, with the consequent loss of its entire contents, not to mention the loss of the still and the attendant dangers, Dr. Rittman proposed to himself first to convert the petroleum to be treated to vapor. Then, when it was in the vapor or gaseous stage, to subject it to such pressures and temperatures as would result in the production of gasoline, or, pushed further, of benzol and toluol, and the other similar compounds which together form the mother substance, in coal tar, of so many useful products, dyes, medicines, constituents of explosives, etc.

In practice, the apparatus used is represented in the accompanying diagram. A suitable tube of iron, closed at one end and opening from the other into a condenser of appropriate form, has across its upper section a septum, pierced, upon which is placed a layer of lumps of fire clay, balls of iron, or other non-melting substance. Connecting to the main tube through a smaller one is an oil cup so arranged that its contents may drip down slowly onto the layer of fireproof material above the septum. On the other side of the tube a smaller tube leads off to the familiar pressure gage.



The experimental apparatus of Dr. Rittman.

Surrounding the main tube is a coil or coils of wire, by which, through the application of an electric current, the tube may be raised to any desired temperature.

The oil dropping upon the heated fireproof material is converted into a gas or vapor. Any solid residue which would normally appear to collect upon the fire brick or iron balls is washed down into the main tube, and thence into the condenser, by the gasoline and gasoline vapor inherent in the petroleum. As the vapor or gas collects in the main tube and is heated by the hot electric coils, it creates its own pressure, which is regulated by the amount of crude oil permitted to flow down, and also by the amount of heat applied. It is further subject to regulation through the valve which leads from the condenser.

#### The Advantage of Treating a Vapor Instead of a Liquid.

By treating vapor of petroleum instead of the liquid itself, Dr. Rittman is able to go much farther than can be accomplished by the use of the still. In the still, pressures of 100 pounds are high, and an undue increase of heat after that pressure is reached is usually dangerous. Gas, however, is compressible to a much greater degree than a hundred pounds without danger of explosion in apparatus of the type described, and,

in experiments, Dr. Rittman has succeeded in working with a pressure exceeding 500 pounds. With such pressures as this, and with a degree of heat perfectly controllable by the means described, the Rittman process not only delivers gasoline to the amount of from 50 to 75 per cent, but permits him to obtain benzol and toluol at will.

These substances, and others closely allied to them, form that mother substance which, derived from coal tar, is used for making dyes and other materials so much in demand in many arts. It is his production of these in this new method of "cracking" that has caused Dr. Rittman to be so misquoted and so untruthfully advertised in many newspapers which have published a garbled account of the facts as given out by the Secretary of the Interior. There seems to be no question in the minds of those practical chemists who have looked into the matter, that a new principle of petroleum treatment has been made commercially possible, but, as Dr. Rittman himself points out, there is only a belief to go upon, practical applications as yet not having been made. Patents have been applied for which are to be dedicated to the American people, and not held as Dr. Rittman's personal property.

The products of the Rittman process which pass into the condenser are, of course, as easily subjected to further heat and temperature, in the ordinary still, as any other petroleum distillate. The great advantages of the process are safety and speed of operation. Laboratory tests prove the benzol and toluol made synthetically in this Rittman process to be identical with those derived from "natural" coal tar.

Practical tests are to be made in a commercial way of the new discovery in the immediate future, although there is no definite announcement at this time as to who will do it or where it will be done. The development of the new idea in treating crude petroleum in the vapor phase instead of the liquid phase will be watched with interest, not only by the oil industry and its allied commerce, but by all users of gasoline and those to whom the coal tar dyes and coal tar constituents of explosives are of importance.

### The Marble Columns of the Lincoln Memorial

By J. P. Kirsch

WHEN Congress made the appropriation of \$2,500,000 for the Lincoln Memorial at Washington, D. C., everyone understood that it was to be something of grand proportions, but few realized the magnitude of this great memorial at that time, although figures were published in papers and magazines throughout the United States. Mere figures, however, are not readily grasped by the average man, and until he actually sees the object it is hard for him to obtain an adequate conception of its dimensions.

On the front page of this issue are some pictures of the huge columns of this memorial in process of being formed. One cannot help but be impressed with their mammoth proportions. These will be the largest columns of their kind in the world. Each block of marble as it comes from the quarry weighs about thirty-five tons, and twelve of these huge blocks are required for each column. There will be thirty-eight big columns in the Lincoln Memorial, and each column will be 46 feet high, weigh 192 tons when completed, and will be valued at \$15,000. As the thirty-eight columns will require four hundred and fifty-six blocks of about 25 tons each, the total weight of marble will approximate 11,400 tons. This mass of stone is being shaped into columns at Marble, Col. The complete story of the work done on these columns, after leaving the quarry, is shown in the front page illustrations. First the blocks are sized with wire saws to the required thickness. After that they pass through the barrel saw, where they are cut into drums. The barrel saw is in the shape of a drum, with the lower end open and the lower edge doing the cutting. From the barrel saw the stone drums then pass to large lathes, where they are trued up. The next process is to flute the drum. This is done with carborundum wheels operating on opposite sides of the drum simultaneously, as shown in the photograph. After being fluted, the drums are ready for hand finishing and fitting so that each drum will register perfectly with the one above and below when the column is assembled at its destination.

**Franco-Swiss Railroad Connection.**—A piece of engineering work which has an important bearing on international railroad traffic is the completion of the Moutier-Granges tunnel. This will afford a long-desired connection from the east French railroads to the Swiss lines centering at Berne. From here, transit is made by way of the Lötschberg line to the Simplon tunnel and to Italy. The length of the Moutier-Granges tunnel is somewhat over five miles. Work was commenced on November 6th, 1911, being retarded by strikes in 1913 and by the recent mobilization, after which it was taken up again on September 30th, 1914. Drilling work is now completed.

# Saturn, the Most Interesting Planet of the Solar System\*

## Its Rainbow Rings and Many Moons

By Abbé Th. Moreux, Director of the Observatory of Bourges

FOR the next few months Saturn will be in a favorable position for observation, and the attention of astronomers throughout the world will be attracted to this most beautiful and most wonderful of all the planets.

That which especially distinguishes Saturn from the other planets is a most peculiar system of thin rings, surrounding it in the plane of its equator. The inner edge is about 7,000 miles from the cloudy surface of the globe of Saturn, and the width of the system is about 40,000 miles.

If these rings were solid, they would form a race track wide enough for five balls the size of our earth to roll around, side by side, without touching.

The plane of the rings is inclined to the plane of the planet's orbit about 27 degrees. It follows, therefore, that in the course of the thirty years required for its revolution around the sun, the rings appear at least twice on edge as seen from the earth. Sometimes they appear as a wide ellipse, sometimes very narrow, and again as a simple bright line, which disappears completely in small instruments. The greatest opening of the rings from our point of view occurred in 1899. Starting from that date, its apparent width diminished until 1907-1908, then began to increase, and reaches its maximum again this year.

This planet with such striking peculiarities has naturally offered to astronomers some of the most complex problems. In fact, as soon as Galileo, in 1610, directed one of his first telescopes toward Saturn, which was then considered the most distant of the planets, he was amazed at its strange appearance.

He was far from suspecting the correct explanation of the phenomena, it is true, for in his small instrument the two extensions of the rings looked like two small round satellites. But, in order to assure the priority of his discovery, he composed an obscure anagram, which, later, was interpreted to mean *Altissimi planetam tergeminum observavi*. That is to say, "I have observed the most distant of the planets to be triple." He compared the two extensions to two servants helping an old man on his way.

In 1612, however, the appearance changed. The rings of Saturn were edgewise toward the earth, and, on account of their slight thickness, were invisible to astronomers, who, at that time, had only imperfect instruments. Galileo was much embarrassed. "Saturn," he remarked, "seems, as in the fable, to have devoured his children." This perplexing disappearance became for him an insoluble enigma, and he died without learning the true explanation.

Some years later, Cassendi again observed "the triple star," as he called it, but it was not until 1655 that Huyghens discovered the ring and solved the mystery. At least, he solved the problem which presented itself to Galileo, but with the increase in size and quality of telescopes new difficulties arose.

In 1675, Cassini discovered that the ring was not single, but was divided into two parts by a dark line, and to-day, with our more perfect instruments, we can distinguish a dozen concentric circles all differing in size and brightness. Still further; spectral analysis has shown that with the most powerful telescopes, we ought to recognize thousands of luminous bands, all revolving separately and each at its own special rate around the giant globe.

As to the nature of the rings, up to 1850 no one had ventured to express an opinion. In that year, Bond, a young American astronomer, announced to the world a sensational discovery. While observing Saturn, one evening, Bond discovered that one of the rings was not perfectly opaque. The disk of Saturn was visible through it. The ring, therefore, must be made up of particles of dust, held in position by their common attraction, millions of little satellites, which have not been able to reunite with the central sphere. The fact that the different bands of particles reflect different amounts of light from the sun will explain all of the observed phenomena.

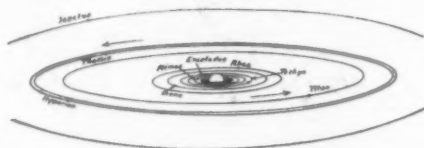
This meteoric theory of the rings is the only one that can possibly explain their existence, for, according to the law of gravitation, it is certain that a solid or liquid appendage of this form would be unstable, and would break up and fall back upon the planet.

This meteoric structure, however, does not guarantee the ring against disaggregation, and what astronomer has not dreamed of being on the watch, some day, and observing a part of the rings breaking up and falling back upon Saturn with a terrible crash!

This hypothesis was considered less chimerical when, in 1851, Struve, after a series of measures, startled the scientific world with the incredible news that the diameter of the ring system appeared to be diminishing, and that the rings were approaching the ball of the planet. "Three centuries hence," said Struve, "the rings of Saturn will have disappeared, buried in the mass of the great sphere which is drawing them in." Modern measures do not confirm his idea, and astronomers to-day assert that, if there is any change in the dimensions of the rings, it must be periodic. The whole system may act like an elastic girdle. Between the rings, the dark intervals must be constantly changing. Only the large divisions have a relative stability, due, without doubt, to the presence of the satellites. We have a striking illustration of the influence of the latter upon the distribution of matter in the apparent gaps in the distribution of the asteroids, gaps which occur at places where the period of an asteroid would be commensurable with that of Jupiter.

The luminous ring surrounding Saturn is not the only peculiarity of this remarkable planet. Of all the planets Saturn has the greatest variety, and the largest number of satellites. In 1655, Huyghens discovered the largest, Titan, whose dimensions are comparable with those of our moon. Between 1671 and 1684 Cassini discovered four; in 1789, William Herschel added two more; and in 1848 Bond announced the eighth, Hyperion.

Thus, within two centuries eight satellites had been detected, revolving around the planet, but this number was not increased until recently, when the application of photography brought the list of recognized satellites up to ten. Themis, the tenth, discovered in 1904 by W. H. Pickering, is a tiny little moon not over thirty miles in diameter. It has taken its place in the



Orbits of the nine inner satellites of Saturn. The first four satellites are much nearer to Saturn than the moon is to the earth. Mimas is nearest of all, and Phoebe the most remote. The latter is not shown on the diagram. The extreme diameter of the Saturnian system is 16,000,000 miles.

middle of the family, while Phoebe, discovered by the same observer, revolves outside of all of the other satellites, and greatly extends the dimensions of the Saturnian system.

Iapetus, formerly the most distant, revolves around Saturn at a distance of about two million miles, but Phoebe describes an orbit the radius of which is eight million miles. Saturn and its cortege of ten moons occupy more than thirty times the amount of space required by our earth and its modest satellite. The Saturnian family is, in fact, a reproduction on a small scale of the whole solar system.

We shall leave to the astronomers and authors of cosmogonies the discussion of the formation of this distant world system, but we cannot fail to mention a theory, which has received some approval, of the birth of the rings.

If a globule of oil is dropped upon the surface of a liquid of the same density (for example a mixture of alcohol and water), and if, by means of a needle, a rapid motion of rotation is imparted to the globule, the spherical mass will flatten out, and a ring may detach itself from the equatorial region.

This very suggestive experiment, due to the Belgian physicist Plateau, is still cited in books on cosmography, to illustrate by a concrete example the theory of the formation of the rings of Saturn. Now from the point of view of mechanics, if this actually happened, there would necessarily result an acceleration of rotation of the globe after the departure of the ring. But experience, or rather observation, shows just the opposite. The ball of the planet rotates upon its axis in 10 hours 14 minutes at the equator, while the inner edge of the bright ring completes its revolution in 7 hours 12 minutes, and the inner edge of the crape ring, in only 5 hours and 45 minutes.

Since they turn faster than the planet, the rings can never have formed a part of the sphere which they surround. They must have come from the out-

side, possibly from some satellite, spoiled in the making, so to speak; fragments of some disrupted mass, which have never been reassembled.

What will become of this curious formation? According to Clerk Maxwell, the rings have only a temporary stability, and a day will come when rapid disaggregation will begin on both the inner and the outer edges. That time has not yet arrived, although different observers have noted some changes along the edges of the rings. I, myself, during the year 1914 (and also in 1913) discovered some gaps in the inner dark ring.

Modern astronomers have weighed all of the planets. Saturn proves to be the lightest. Placed upon a vast ocean, it would float like an ordinary cork. The ball of Saturn is merely a mass of hot gas, the temperature of which is equal to at least 800 or 900 deg. Cent. Organic life cannot exist in its boiling hot atmosphere.

As seen from the equator of the planet, the ring rises into the heavens like a luminous arch, perpendicular to the horizon on each side. On account of its slight thickness it would appear as a thin band of gold dividing the celestial vault. But if one should proceed toward either pole, the ring would appear to widen out, and from the hemisphere illuminated by the sun, it would show various shades and constantly changing forms. Sometimes the shadow of the planet would be projected upon some part of the ring, and would add to the novel aspect of the scene.

Here and there through the wider spaces between the rings or through their thinner portions one might see the sky, studded with stars. Up there would be seen the same constellations that we see from the earth; the Great Bear, near the north pole, blue Vega, and red Arcturus, but the presence of so many moons, showing various phases, would add a weird touch to this remarkable picture.

What a shame that there are no living beings on that distant world to enjoy that strange fantastic illumination and the fairy scene revealed by those celestial lights! But in the boundless space of time years count for little, and among the millions of worlds very few are chosen to be the abode of life. When, for example, in the distant future, Saturn shall have cooled somewhat and a crust formed on its surface solid enough to support living beings, by that time the sun will already have begun its decline. Even to-day it imparts to Saturn a maximum temperature of only 176 degrees below zero, Cent., and from Saturn its disk appears only about one tenth as large as it appears from the earth. But, on the other hand, looking back into the past, when Saturn was still a self-luminous star, why could it not have played the part of sun to its own satellites.

From Titan, the planet would appear as a disk ten times as large as the sun looks to us, while from Mimas, the nearest satellite, Saturn would appear as a great luminous area, 38 degrees in diameter, sixty-seven times greater than the sun, as we see it. Our cover design pictures the planet as it would appear if it could be seen from its moon Titan.

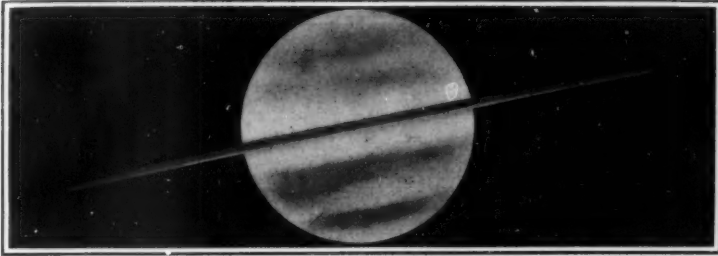
If one can imagine that there are intelligent beings up there to behold those imposing celestial scenes, for them Saturn would be the center of the universe, and they would little suspect that at this moment dwellers upon the earth, a little insignificant point of light, are speculating in regard to their existence.

## Cleaning Automobile Motors With Denatured Alcohol

MOTORISTS are only too familiar with the hard layer of carbon which, with the lapse of time, forms a tenacious coating on the sides of the cylinders and pistons of motors, so as to seriously interfere with their proper functioning. To get rid of this, says *Cosmos*, it is necessary either to scrape the interior of the cylinder, which necessitates complete dismounting, or to employ the oxygen process, which is much easier and more effectual, but is not at every one's command. Our colleague *Omnia* announces a new method, which can be made use of by any one, and without special apparatus—cleansing by alcohol. While the motor is still quite hot we introduce into each cylinder, by the aperture in the spark plug, for example, a glassful of denatured alcohol (a wineglassful for small bore and an ordinary glass for larger bore). The motor is then turned rapidly by hand to distribute the alcohol to all parts of the explosion chamber. It is then allowed to stand for an hour or two, when the operation is re-

\* Translated for the SCIENTIFIC AMERICAN from *La Science et La Vie*.



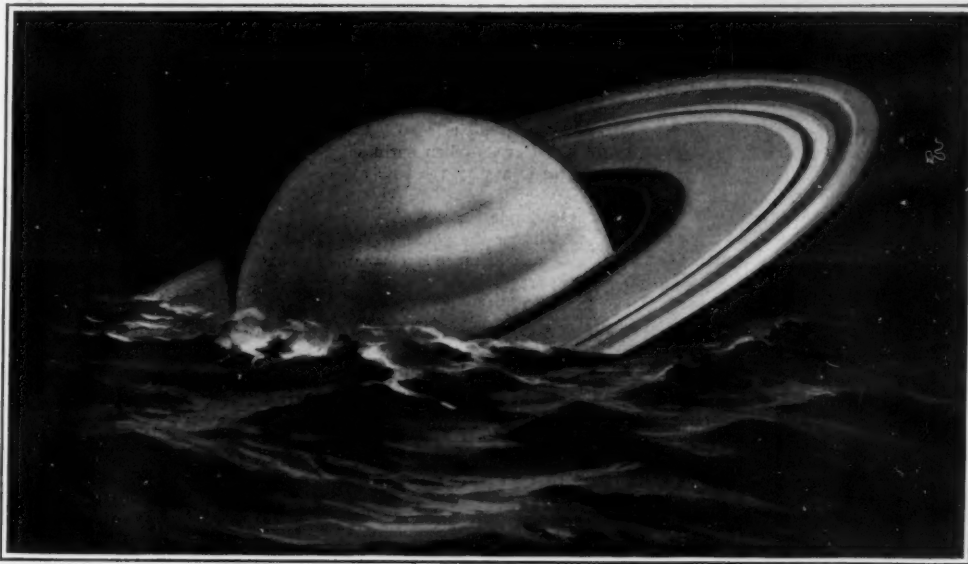


The ring appears here as a mere thread of light.



1907 the ring of Saturn was invisible in small telescopes.

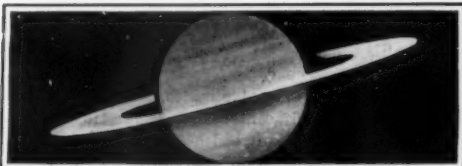
peated to make sure the action is complete. The rôle of the alcohol is to dissolve the smut, the bituminous products which cling to the walls of the cylinder; those particles of carbon which are not dissolved, but are thus deprived of support, become detached. The motor is then set going, and there issues from it a dense smoke with which solid particles are mingled. This does not, perhaps, give the absolute cleanliness of the oxygen method (previously described in *Cosmos*), but such as it is it largely suffices to enable a motor to resume normal functioning. Since this method of cleaning is extremely simple it is a good plan to make use of it regularly at the end of every three



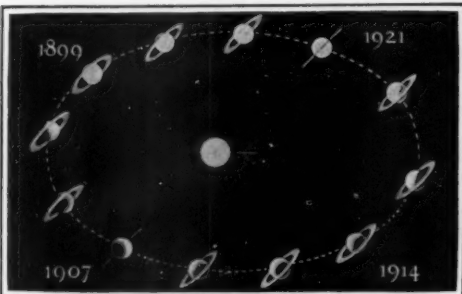
Saturn is the lightest of all the planets. Placed in an ocean large enough, it would float like an ordinary cork.

or four thousand kilometers of travel.

**Foreign Patent Doings.**  
—The Belgian government has been a migratory institution for some time, and the various practitioners before its departments have been traveling with it. Some of these attorneys have traveled from Antwerp to Ostend, and thence to Havre; while a few have established branches in Holland, according to advices they have sent to their correspondents in Washington. The German Patent Department, in Berlin, has been practically stripped of all its able-bodied clerks, the army having claimed their services, and the force remaining is only sufficient to file patent applications.



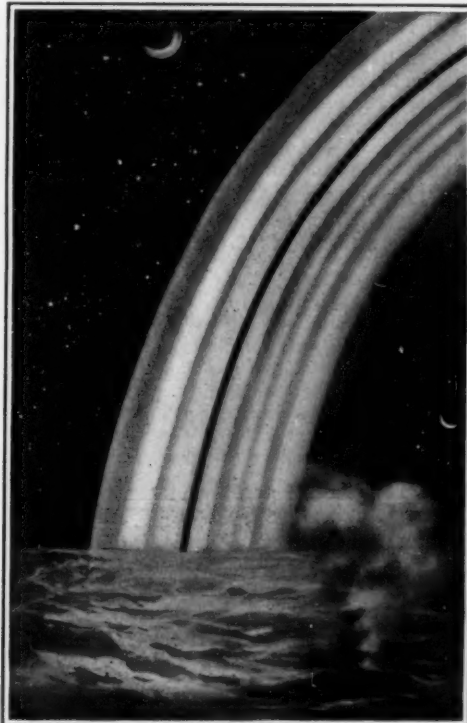
In 1909-1910 the ring of Saturn resembled a very narrow ellipse.



Saturn as seen from the Earth in different parts of its orbit.



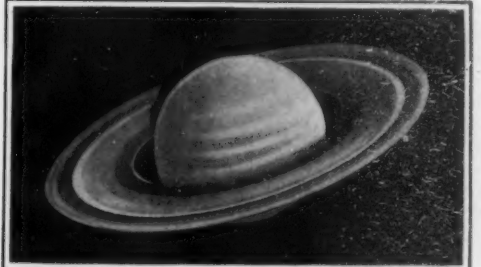
Saturn and its principal satellites.



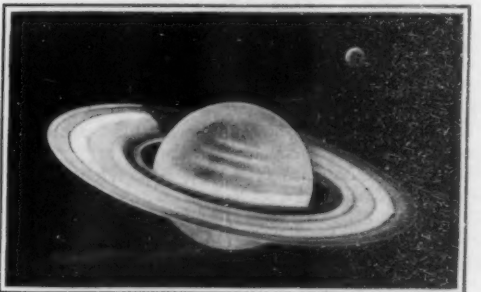
When observed from a point near the equator of the planet, on the side toward the sun, the ring would appear in the heavens like a great luminous arch, showing different colors and changing forms. This ring must be made up of particles of dust held in position by their common attraction. They are, therefore, millions of little satellites unable to reunite with the central sphere.



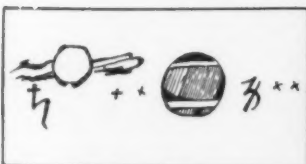
In 1911-1912 the perspective of the ring was a wide ellipse.



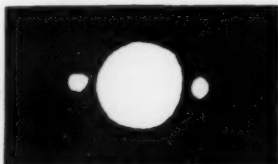
This year the ring of Saturn presents its maximum opening.



Saturn is almost 813 times as large as the Earth.



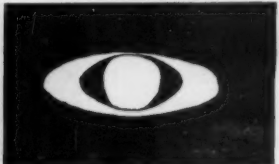
Jupiter with its satellites and Saturn, by Huygens.



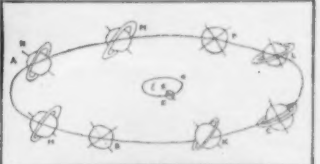
Saturn, triple (Gassendi, 1633).



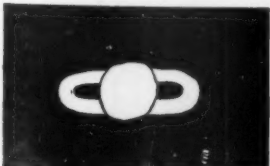
Saturn (Riccioli, 1630).



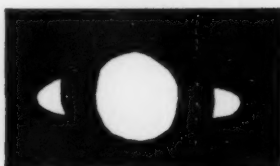
Saturn with two anses (Gassendi, 1636).



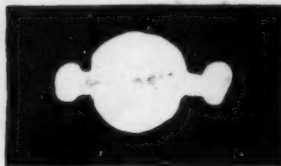
The phases of Saturn explained by Huygens.



Saturn (Gassendi, 1651).



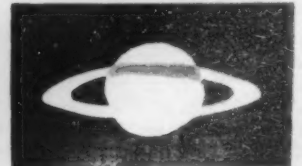
Saturn, triple (Hévélius, 1645).



Saturn with two arms (Hévélius).



Saturn (Gassendi, 1646).



Saturn (Huygens, 1657).

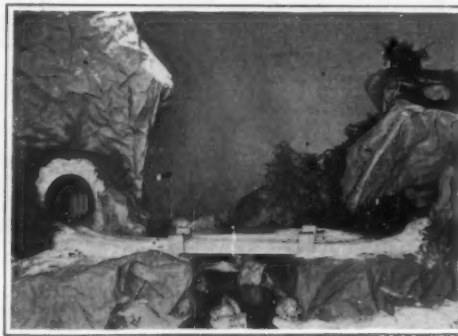


Demonstration of the birth of an iceberg.

## Table-Top Geography

### Hints on the Construction of Simple Models

By Percy Collins



Model illustrating salient features of a railroad.

ALL experienced teachers must often have felt the difficulty of ascertaining beyond doubt that their class of young students has really comprehended the facts of geography which have formed the subject of the day's demonstration. The various points have been explained with all possible lucidity, while each verbal description has been supplemented by such pictures and diagrams as the equipment of the school, and the wit of the instructor, have rendered available. The answers of the young folks seem to indicate that their minds have indeed achieved the desired advance in knowledge. But do they really understand? This is the question that continues to haunt the conscientious teacher, who is only too keenly alive to the obstacles which confront the youthful traveler along the paths of learning. Take, for example, such commonplaces of geographical expression as "cape," "isthmus," "straits," or "delta." If he is to grasp the full significance of these terms, the country-bred child must evoke a fund of imagination out of all proportion to that which he may reasonably be assumed to possess. Of course there are plenty of keen, 'cute children about. But it is the dullards who set the pace of the class, and consequently it is with them that the educational expert must primarily concern himself.

Short of showing children the actual things about which we are speaking, models are undoubtedly the best means of setting their intelligence to work. But the best equipped school in the country would probably be nonplussed if asked to back up by a model every fact set forth in its geographical text-book. Yet there can be no question that this is the ideal method.

Considerations such as these lend special weight to the counsels of Mr. W. Fortune Fowler of London, England, who is the inventor of what has been called the "geographical toy." As the result of long experience he has come to the conclusion that every teacher should be capable of assuming the role of model-maker at pleasure; and, further, that in this matter the teacher should acquire the resources and deftness of the "quick change" artist of the vaudeville stage. The teacher should have at his disposal an accumulation of odds and ends capable, at short notice, of being pulled, or twisted, or pinned, or patted into shapes suggestive of the various types of scenery presented to us by the earth's surface. The aim is to make geography so real and clear to the child that it can without difficulty, and with that keen enjoyment which is the best spice for mind-hunger, comprehend such things as latitude and longitude, time and seasons, land contours, the flow of rivers, and how mankind, by his engineering feats, has altered Dame Nature's antiquated arrangements to his own advantage.

The apparatus and materials necessary for attaining these results are so simple that anyone can procure them. First there must be a large table having a top that may be scratched or punctured with impunity, and stout, rigid legs. This must be placed in a good light before a neutral-tinted (preferably bluish) background, which may be either a wall, or a screen specially prepared for the purpose. The table, which is to be used as a kind of stage, should not be close up to the wall or screen, but about two feet away from it, as the operator will have occasion to pass frequently to the rear of his model when the latter is under construction.

Among the more important materials for impromptu modeling are plenty of old card and thin wooden boxes, large sheets of paper of various colors and thicknesses, sand or dry mold, paint in powder to be mixed with fine sand in different shades of color, and a liberal supply of glass-headed pins such as may be purchased at any drapery store. Besides these things it is well to have at hand a miscellaneous collection of oddments comprising bits of broken glass, sheets of cotton-wool, plaster of Paris, sawdust, a sheet or two of plate-glass, some coarse gravel, and, in fine, anything else that seems likely to prove of service. Moss, by the way, should be kept in two forms, first in its ordinary dried state, when it may be used to represent clumps of trees or dense thickets, and secondly in a finely powdered condition. This powdered moss is easily made

by rubbing dyed moss (which is sold for decorative purposes) through a sieve. When sprinkled upon any surface it imparts to it a very realistic appearance of close-growing turf.

By means of these simple materials wonderful results may be gained, as witness the photographs reproduced upon this page. In one instance a companion picture shows the actual appearance of the modeled cliffs as viewed from the rear. This indicates the simplicity of the method, and the rapidity with which a desired effect may be achieved. The cliffs are really nothing more than sheets of appropriately colored paper pinned around piles of books, boxes, etc. The addition of a little powdered moss, colored sand, and a number of crumpled paper boulders completes the foreground, while a sheet of green-blue paper, a pictured ship, and some clouds of cotton-wool make a pleasing background.

In another instance the object of the model is to display some of the salient features of a railroad as governed by the character of the country through which it passes. To the right a train is issuing from a deep cut, whence it will run along an embankment, to a bridge across a rocky river. Its further progress is barred by a signal, which protects the rear of another train, which is disappearing into a tunnel on the observer's left. Here, also, crumpled paper, moss and colored sand are the chief materials employed; but a sheet of plate-glass has been used to simulate water, while a child's clockwork railway has also been pressed into temporary service. A third example is designed to illustrate the formation of an iceberg. Cliffs of dark brown paper bound the deep gully through which the glacier creeps to the sea, and a white paper berg is represented as having just broken clear of the glacier's foot. Paper of different colors, a few strands of cotton-wool for breakers, and a little sprinkled plaster of Paris, are the sole ingredients for this magical result!

With a little practice, these geographical demonstrations can be arranged in a surprisingly short time, varying from ten to fifteen minutes (as in the case of the iceberg) to perhaps half an hour for an elaborate scene like the railroad. The aim should be to gain the best possible effect with the least possible expenditure of time—though there must be no skimping, since

children are critical in a high degree, and will be quick to recognize any incongruity. It will be found a great advantage if some kind of frame, or proscenium, can be arranged through which the model can be viewed. In this way the attention is concentrated, and a more realistic effect is produced. Moreover, for their own good the children should be encouraged to make suggestions, and to help in the preparation of the models, the teacher, however, being always at hand to make his guiding influence and personality felt.

### A Slide Rule With Radical Improvements

MANY important improvements are to be found in a slide rule recently put on the market, which enlarges its field of usefulness materially. Not only will it perform every operation of the common slide rule, but it will add or subtract as well. The "direct reading" feature of the instrument is another radical improvement; an opening known as a "keyhole" is cut through each of the fixed scales, and through these openings appear red letters marked on the sliding scale. A table on the back of the instrument shows what problems may be solved by setting the sliding scale at the different positions indicated by the red letters. For instance, with the slide set so that the letter *O* appears in the keyhole of the upper scale, one may read cubic inches on one of the movable scales, and the equivalent cubic feet on the adjacent scale. By setting *g* under the other keyhole we can read on one scale the head of water in feet, and on another the corresponding pounds per square inch. In a similar manner the answers to over a score of problems that are constantly being met by engineers may be read off directly. Still another feature makes this slide very useful to electrical engineers, for it supplies a complete wire table. Knowing any one of the following values, the other five may be read off, viz: diameter in mils, area in circular mils, square mil area, pounds per thousand feet, resistance in ohms per thousand feet, size wire B. & S. gage. These and many other problems too numerous to describe in this short note may be solved at a glance with this slide rule. The inventor of it is George W. Richardson, ex-chief electrician of the U. S. Navy.

### Trade-marks in China

THE protection of a trade-mark owned by a foreigner is one of considerable difficulty in China, as "extra-territoriality," with all its attending complications, exists there, consequently foreigners residing in China who infringe a trade-mark are subject only to the laws of their respective countries. There are, therefore, no uniform laws as to trade-marks or any other property rights to which non-Chinese residing in China are amenable.

In recent years the question of trade-mark rights in China has become one of great importance and of great difficulty, especially in cases where Japanese are involved, because the Japanese code of ethics, whether commercial or diplomatic, does not coincide with that of western nations. In some cases of dispute between American and English manufacturers in regard to infringements of trade-marks a solution of the difficulty has been arrived at by applying certain standards of commercial ethics as understood and appreciated by business men of these nations. The Japanese view, however, appears to be that a trade-mark, no matter how long it has been used and recognized, is not entitled to any respect or protection unless registered in the proper department of government in Japan.

Anomalous as it may seem, the trade-mark laws of America, Great Britain and other nations have been held not to extend, under the theory of extra-territoriality, to China, although all other branches of law applicable to local conditions are constantly enforced by the judicial tribunals of the various nations enjoying treaty rights in China, under the principle or theory of extra-territoriality. Hence, in cases of infringement of trade-marks, redress can be secured only through diplomatic and consular channels or voluntary submission of disputed points to arbitration.



Cliffs by the sea modeled in paper, sand and moss.



The model above, as seen from the rear, showing improvised apparatus.



## Some Interesting Automobile Novelties

### Lockers for Automobiles

WHAT assurance has a man who leaves his car at a garage that his machine will not be used in his absence? What assurance in this case can the manager of the garage give his patrons? It is an open building, to which all have access, and while there is little danger of the loss of a car it not infrequently happens that chauffeurs or even employees of the garage go out for a joy ride with a car to which they have no right. Now the matter is not liable to be detected unless the car meets with an accident. Another annoyance lies in the borrowing of tools from the tool box of the car that is nearest at hand. Frequently the tools are not returned, and gradually the stock dwindles. In order to provide better security for cars and car accessories the locker system should be employed, as in the accompanying illustration. Closed and locked about each car is a stout iron fence, which will make the car inaccessible for pilfering and render it impossible for any one to take the car out without a key to the barrier fence.



Locker stalls for automobiles.

### A Barrel-shaped Garage

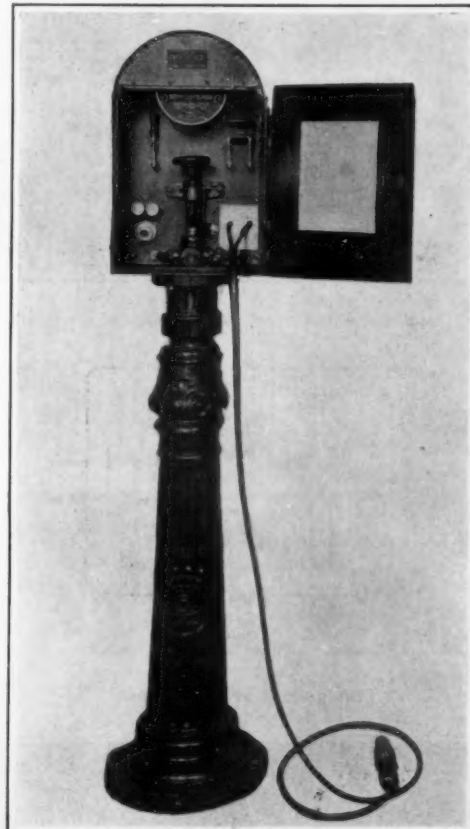
THOUGH it resembles a big barrel, this odd structure is in reality a garage and a very good one. It is built of 2-inch boards of 14 foot length, and the width of the structure is 12 feet. Instead of being held together by nails, the building is kept solid by four heavy iron hoops, which are held snug by bolts and nuts at the top. Only an hour is required to set up the building and it can be taken apart for setting up elsewhere in a few minutes. This portable feature makes it valuable for other purposes besides a garage; as a prospector's cabin, summer cottage, or other non-permanent structure it is ideal. As it is practically airtight, it has a particular value in freezing weather, for the engine of a car that has been operated in the daytime is sufficient to heat the interior and keep it warm all night, or if the car is idle, a very small heating apparatus will keep the garage from undue chill. In fact, the staves and floor and ends, with their tongued



This is not a barrel, but a garage.



Entrance to the portable garage.



Sidewalk charging outfit for electric vehicle batteries.

and grooved joints make a building almost as tight as a tank. Of course a few coats of paint will make it impervious to rain. This building method is very economical as there is no waste lumber and the cost of assembling is slight; the parts fit together so simply that any unskilled man can set it up in a short time. It is not necessary to set up a permanent foundation, as the building is very light; in fact, it can all be carried, when dismantled, upon a single wagon. In order to simplify the construction, the only openings are at the ends, a double door with windows, and in the rear a circular window. This garage is on the home-place of the inventor in Spokane, Wash., where it has been found satisfactory in every particular.

### The First American Twelve-cylinder Car

IN a note in the SCIENTIFIC AMERICAN of January 30th last, reference was made to the increasing number of cylinders in automobile engines, with a hint that twelve-cylinder engines might come into vogue. In support of this prediction we drew attention to the twelve-cylinder "Sunbeam" racing car of British make, which holds some records on the Brooklands track. Our statement that one of these cars took part in the Indianapolis Speedway races is corrected by W. G. Wall, chief engineer of the National Motor Vehicle Company, who reminds us that it was not a twelve, but a six-cylinder "Sunbeam" car that entered the races.

Mr. Wall sends us the accompanying photograph of the first American twelve-cylinder automobile engine which was built by Mr. George Schebler of Indianapolis and put in a car in 1910. As will be noted, the engine

is of V-type with overhead exhaust valves. In view of the present interest in cars of eight and more cylinders it is notable that this original "twelve" has been running for the last five years and is still in use.

### Vehicle Batteries Charged at the Curb

ANOTHER invention has been perfected for the convenience of motor vehicle owners. Electric cars can now have their batteries charged at the curb without entering the garage. The charging outfit is a very compact apparatus capable of supplying any electric pleasure or commercial vehicle with enough current to send it on for five to twenty miles on ten minutes' to one hour's charge.

A slate panel is mounted within an electrically welded steel box only accessible through a steel spring-locked door. The box contains ammeter, pilot lamp, rheostat, fuses and one main line switch. Connections to supply the service are made through underground cable. A terminal block is provided, accessible through pedestal hand hole. The charging cable folds within the box when not in use. When in use the door of the box can be locked with the cable outside.

To obtain current application is made to garage attendant, who unlocks the charging station. Charges made depend of course upon how much current is taken. The curb station is intended mainly as a "boost" for the machine until it can reach its destination. A Cincinnati man is the inventor.

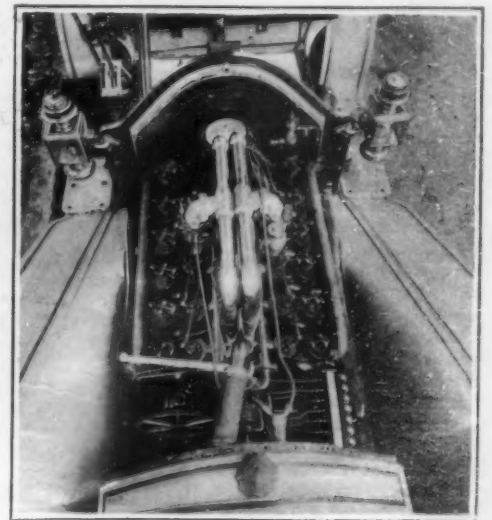
### Speaking Tubes for Racing Cars

ON account of the terrific speed at which automobile racers travel it is practically impossible for the driver and mechanic to speak to each other without slowing down. To overcome this difficulty the device shown in the accompanying photograph was introduced at the Corona race, held near Los Angeles, Cal., on Thanksgiving Day. It was invented especially for the



Speaking tubes on a racing car.

event by Eddie Rickenbacher, and was used by himself and mechanic. It consists of two speaking tubes—one extending from the mouth of each person to one ear of the other—and is combined with the usual head-guard and face mask.



Twelve-cylinder American car built in 1910.

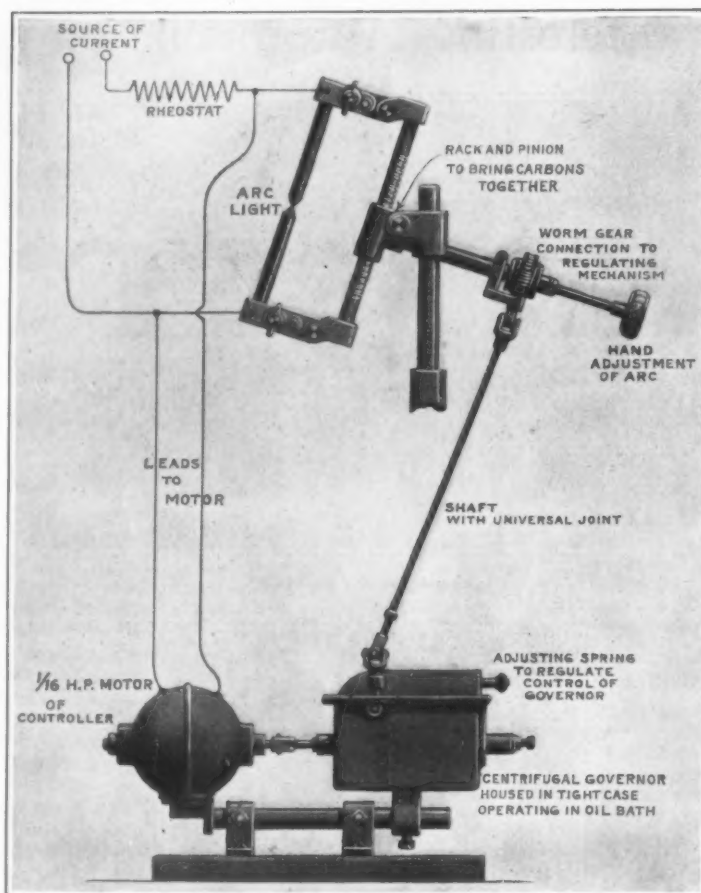
### Arc-light Controller for Motion Picture Projection Apparatus

THE widespread interest that attaches to motion pictures and the constant advances made in apparatus for their projection is a subject of universal concern. The elimination of the disturbing flickering has largely been accomplished, and now there has been perfected a device for controlling the arc lamp so that the source of light is maintained not only constant as regards its position, but also constant in its intensity. This is accomplished in an invention made by H. N. Baker and originally patented in 1909, but since that time developed and put on so practical and efficient a basis that it has found application in moving picture apparatus of the highest grade, and also for arc projectors used in photo-engraving and searchlights.

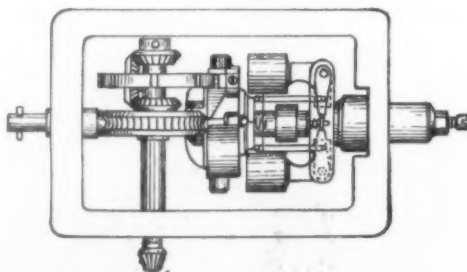
Previously with the hand feed by which the carbons in an arc-lamp were brought together and maintained at the proper distance so as to produce an effective arc, it was not possible to preserve uniformity in illumination, and, as the distance between the carbons varied, there was a corresponding variation in the intensity of the arc as well as a general diffusion of light. Even with a watchful operator, constantly adjusting and feeding the carbons properly, the results were far from satisfactory, while automatic apparatus, in which by some magnetic or other system the carbons were fed mechanically, failed to give the desired results, and even when such mechanism was new there were sufficient variations to interfere with the effectiveness of the projection.

The new device is available for practically any form of hand-fed lamp, and maintains the arc constant so that there is practically no variation in voltage across the terminals. This is secured by means of a motor-driven controller, where a 1/16 horse-power electric motor is connected directly across the arc and is so wound that it will respond to a wide range of potential. The main axis of the armature carries a centrifugal switch, so that when a certain speed is exceeded the weights moving out from the center throw into operation a system of gearing, which connects with the lamp mechanism and moves the carbons together. The speed of the motor depends upon the voltage across the arc and this naturally depends upon the separation of the carbons. If the carbons are separated widely the voltage naturally is greater and more current passing through the motor increases the speed of revolution. This affects the centrifugal governing device and communicates the motion, suitably reduced, to the regulating mechanism. This brings the carbons together until the normal voltage is restored, when the speed of the motor falls and the centrifugal mechanism ceases to operate.

Instead of a variation from two to six volts ordinarily encountered, the potential difference across the arc can be held to less than one tenth volt and the arc maintained for several hours absolutely constant and in the position set at the first adjustment. The shaft connecting the centrifugal governor with the regulating mechanism is telescopic and mounted on universal bearings at either end, so that the lantern may be shifted from ordinary projection apparatus to that for moving pictures, and the whole control system is regularly connected and housed so that it gives very little trouble and can run for hours without adjustment or attention. Not only is the arc maintained constant, but uneven and unnecessary wear of carbons is prevented and stopping for renewal or adjust-



Apparatus for eliminating the flicker of arc lights.



Centrifugal governor.

The gearing of the governor.



Welding water and gas mains.

ment of carbons during the course of a performance is obviated. By means of an adjustable spring against which the centrifugal governor acts, regulation can be effected to any desired voltage or length of arc, and the control will act surely and automatically.

As used with the projection apparatus of several of the large motion picture companies, the new speed controller has served to decrease the flickering and variations in intensity of illumination to a marked degree, and as a result of experimental installation other machines are being equipped with this device. It has also been used to control the arc of a large projection lantern in the photo-engraving laboratory of a bank-note company, where an arc is maintained between carbons 1 1/4 inch in diameter for the upper carbon and 1 inch in diameter for the lower. The speed controller also has been applied to searchlights, so that it is possible to maintain constant the beam of light emitted and regulate its direction by operating gear from some distant point, such as a bridge or observation platform, without the presence of an operator at the searchlight itself.

The motor of the arc controller is so small that the consumption of current is inconsequential, and the increased economy at the arc itself more than compensates for the small amount shunted through the motor. The latter is so wound that it will respond to any amount of current at the arc, whether it be five or more than one hundred amperes. The important additional consideration is the fact that the attention of the operator is released from the lamp and he can devote himself entirely to the control of the films, and thus secure the best results. The entire mechanism has been so well arranged and developed that it promises to have a striking effect upon motion picture projection, and especially where high power lamps are produced. The accompanying diagrams indicate in a general way the operation of the apparatus and the construction of the centrifugal governor.

### Welding Water and Gas Mains

THE gas welding processes which have come into vogue during recent years, particularly the oxy-acetylene and the oxy-hydrogen procedures, have been extending themselves into fields of activity far removed from the machine shop and foundry. Among these new applications is that of steel pipe laying. Already mains have been laid by gas welding in the cities of San Francisco, Chicago, and Peru, Ind. In fact, at San Francisco, in addition to a high pressure gas main in the city proper, the entire system of gas and water mains for the Panama-Pacific Exposition has been gas welded.

One of the great advantages seems to be the reasonable prospect of a long life for the joint—of a life as long as that of the pipe line itself. Apparently, gas mains in the past have had to be abandoned when only partially worn out because of deterioration of the joints. The new procedure does not employ any other metal markedly different from the pipe itself at the joints, and a steel pipe line is welded up with a material that is approximately steel. When the pipe is once laid, the whole affair—joints and all—becomes in effect a single piece of steel. It is possible that electrolytic action will be almost eliminated, as such action only takes place where there is a difference in metals. The strength of the joints will be a very considerable percentage of the strength of the pipe. Indeed, it is in general possible, wherever it seems de-

(Concluded on page 277.)



## RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

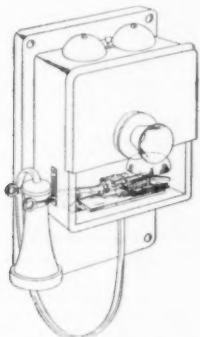
## Pertaining to Apparel.

**FINGER RING.**—J. SCHMIDT, 629 9th Ave., Manhattan, N. Y., N. Y. An object in this invention is to provide a finger ring with an improved form of seat of the Belcher style, and a setting secured to the seat, whereby the body of the ring may be of one metal and the setting of another, or of the same metal.

## Electrical Devices.

**ELECTRIC SIGN.**—A. J. BROWN, 4507 Calumet Ave., Chicago, Ill. This invention relates to advertising devices, and more particularly to an illuminating display sign. It provides a sign constructed so that the advertising matter will be clearly discernible in the daytime and in the nighttime by means of a source of light.

**PARTY LINE LISTENING-IN-DETECTING DEVICE.**—C. A. KRAMER, care of New Wellington Apt's., N. Monroe St., Spokane, Wash. This invention relates more particularly to an indicating or detecting device for each subscriber's set, whereby it is possible to detect any party listening in to a conversation. The



PARTY LINE LISTENING-IN-DETECTING DEVICE.

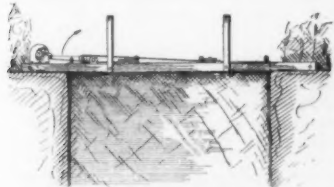
regular telephone bell of the telephone instrument on which the device is used will be permanently bridged across the line and the gongs of the telephone bell will be of the same note as the gong on the detecting device. This is important to the successful operation of the device, as it will enable the operator or any subscriber on a magneto line to test the line for any left-off receivers. He will get the same signal as if the party would answer a call.

## Of Interest to Farmers.

**REVERSING MECHANISM FOR HARVESTING MACHINES.**—H. QUEGWER, Bunzlau, Silesia, Prussia, Germany. The advantage of this device consists in the fact that by the application of a comparatively small amount of force applied near the seat the mowing or harvesting machine can be run backward from the driver's seat and in the automatic release effected before the machine commences its forward motion, thus preventing the parts from being broken.

**MILK STERILIZING APPARATUS.**—J. MÉRIS, 135 Rue d'Alsée, Paris, France. The device comprises a sterilizer in combination with a pump and a closed tank or compressor. The pump is adapted to feed the sterilizer; the compressor tank serves for the regulation of the pressure. The sterilizing apparatus is formed by the combination of two known elements, but constructed in such a way that their conduits and the piping which connect them is of equivalent cross-section, that is to say, constant throughout the path of the milk.

**DAM APPARATUS FOR IRRIGATION DITCHES.**—F. E. MENDENHALL and W. G. ERSKINE, Minnatare, Neb. The invention relates more particularly to that class wherein a dam curtain is maintained in a stretched condition across and forming a stop for a ditch, combined with a time-controlled mechanism for releasing the dam curtain. An arrange-



DAM APPARATUS FOR IRRIGATION DITCHES.

ment of beams sufficiently supports a dam curtain and releases the same at a predetermined time, the confronting faces of the beam being provided with a series of complementary triangular ridges and depressions adapted to rigidly grip the curtain without likelihood of mutilating or tearing the same, even after repeated use.

**RALE TIE.**—I. M. THOMPSON, Bear Beaugard Parish, La. A purpose here is to provide a structure which when placed in position

will become locked to the bale. Another is to provide a tie with a spur having a hooked portion which when driven into place will interlock with the remaining parts so that the spur cannot work loose.

## Of General Interest.

**METHOD OF COLORED PHOTOGRAPHIC REPRODUCTION.**—J. LEWISONS, 88 Fifth Ave., Manhattan, N. Y., N. Y. The process can be used with only two, or with more than three colors, if desired. The principle consists in forming on a blue print a series of superposing blue images, of which the preceding blue color of the image has been substituted by another color before the succeeding blue image has been formed.

**JETTY CONSTRUCTION.**—R. D. A. PARROTT, 114 E. 28th St., New York, N. Y. The purpose here is to provide a jetty construction designed for building jetties, bulkheads, groins, breakwaters, dikes, levees and the like, either on the seashore or along rivers, to prevent erosion and to aid in the deposit of sand or other similar fine material.

**SOCKET ATTACHMENT FOR HARNESS.**—A. H. WESTERMAN, 402 South Broadway, Brownwood, Tex. The improvement has reference to harness construction, and more particularly to a device whereby one strap of a harness is slidably connected with another strap, the device serving to reinforce that strap through which the slidable strap extends.

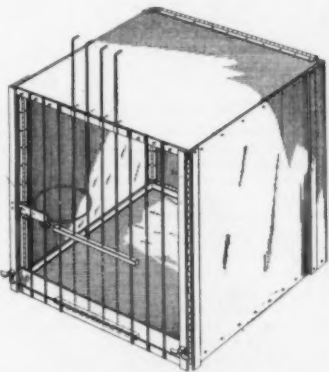
**COMBINATION PARASOL HANDLE.**—D. REICH, 1823 Prospect Place, Brooklyn, N. Y., N. Y. The handle forms a vanity case and is so fitted as to contain a mirror, a powder puff, and a coin case. These accessories are arranged inside the handle of a parasol, umbrella or the like, so as to save women a great deal of unnecessary inconvenience by having the



COMBINATION PARASOL HANDLE.

several articles combined in one, thus permitting the user to have one hand entirely free, while the other is used for holding the parasol or transporting the same, especially in hot weather, while at the same time permitting her to conveniently use the accessories of the vanity case as well as to have the powder puff, mirror, and money all safely stored away in the handle.

**KNOCKDOWN COOP OR CRATE.**—A. J. THUNEMANN, 751 Kentner St., Defiance, Ohio. This coop or crate is more especially designed as an expedition or transportation coop for chickens and other animals, but also serviceable as a crate for storing and shipping merchandise and the like. Use is made of a front, a back, sides, a top and a bottom, the front being connected one with the other by hinges, and the top being hinged to the upper end of

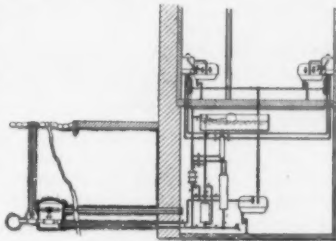


KNOCKDOWN COOP OR CRATE.

the back to fold upon one face thereof, and the bottom being hinged to the lower end of the back to fold upon the other face of the back. Use is also made of an openwork front having a rigid frame, sets of spaced bars attached to the top and bottom members of the frame, the sets being spaced apart to form an entrance to the coop.

**AUTOMATIC DAM.**—W. L. MARSHALL, care of Reclamation Service, 8th and E Sts., N.W., Washington, D. C. An object here is to provide a siphon which co-operates with the operating conduits and valves in such a manner that the dam or crest will be made to fall down when a predetermined fluid height or water level is attained and again raised when the fluid shall have subsided to a predetermined and fixed lower level.

**WATER SYSTEM.**—GERTRUDE M. KREMLBERG, Pittsfield, Mass. The primary object of this invention is to devise a system wherein means are provided for sterilizing and filtering the entire system when found necessary. It is well known that typhoid fever frequently breaks out among those returning in the fall from favorable country districts to their city homes. The trouble is most likely to come from the service pipe between the house and



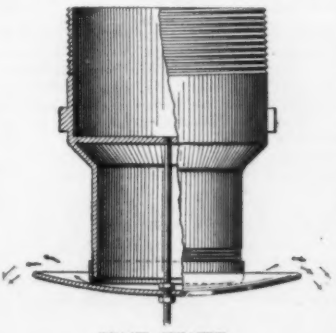
WATER SYSTEM.

the city main. A pipe which is left to dry out absorbs gases and perhaps germinates in the hot season when germ life is ripe and the pipe is open and unused. All the dangerous residue is washed into the city home when the water is turned in. The Kremlberg system prevents these menaces and disadvantages by thoroughly flushing out all traps, boiling out all pipes, and completely airing the house before the return of the household from various winter and summer resorts.

**BARREL HOOP.**—H. LLOYD, 449 W. 2nd St., Lexington, Ky. In this instance means are provided for permitting the circumference of the hoops to be varied, within wide limits, but with small successive increments, or decrements, without impairing the strength of the hoop, and with a comparatively small number of openings in the hoop strip.

**PROCESS OF TREATING INGOTS.**—H. W. HIXON, The Covington, Chestnut and 37th Sts., Philadelphia, Pa. Mr. Hixon's improvement has reference to the process of treating ingots, his more particular purpose being to produce ingots so as to avoid the formation of blow holes and pipe and to render the metal dense, smooth, and readily adapted for rolling.

**LEACH SPRAYER.**—B. F. AMISS, 27 Lake St., Salem, Va. This invention relates to improvements in spraying devices, and particularly to those for spraying leaching fluids, and it provides a structure which will spray the fluid over a comparatively large area, and



LEACH SPRAYER.

which will not become clogged or stopped. The device sprays the fluid through the use of an inverted plate and an adjustable ring co-acting therewith, whereby the fluid may be distributed over a considerable area and in any desired bulk.

**LIFE SAVING APPARATUS.**—A. N. McGRAY, 119 W. 71st St., New York, N. Y. The invention relates to a net or an inclined way for use in connection with ships, especially large ones, whereby easy and safe disembarking of passengers and crew from a ship in distress to life boats can be effected, especially during the running of a heavy sea, and whereby passengers can with ease and safety board a rescuing ship from life boats.

**STATIONARY MORTAR SPREADER.**—F. H. NEUBERGER, East Branch, N. Y. This invention pertains to improvements in mortar spreading devices, and has for an object to provide an improved structure in which mortar is adapted to be quickly and easily applied to concrete blocks and the like without wasting any of the mortar.

**PHOTOGRAPHIC CAMERA.**—J. A. DE ROUZEE, 4th South and Church Sts., Salt Lake City, Utah. This invention provides a camera adapted to receive a plurality of exposures on a single sensitized plate, in predetermined locations; provides means for adjusting said plate with reference to the arrangement designed for the photographs; and provides means for adjusting the ground glass to any position in a camera and to bring the image quickly to any location without moving the subject or the camera.

## Hardware and Tools.

**LOCK FOR MAIL BOXES.**—C. F. UTERBACK, Lock Box 201, Mooresville, Ind. The particular purpose here is to provide a device having improved mechanism for safe-guarding mail placed in the box, either by the owner of the box or by the postman, and having special

provision for enabling the operator to save time, under proper conditions, otherwise wasted in locking and unlocking the box.

**SYRINGE.**—F. S. DICKINSON, care of Becton, Dickinson & Co., Rutherford, N. J. In this device use is made of a combined finger piece and plunger retainer, of which the finger piece is held on the barrel and the plunger retainer is in the form of a coil spring attached at its ends to the finger piece and engaging the outer surface of the plunger so as to hold the latter against accidental dropping out of the barrel.

**WRENCH.**—J. EHRHARD, Curtis, Okla. This wrench is of comparatively simple construction and admits of a great variety of uses. The invention relates to means for rendering the wrench adjustable quickly and yet accurately. It contemplates various other advantageous features, for the purpose of improving the general efficiency of the wrench.

**MECHANICALLY OPERATED SCISSORS.**—W. I. JONES, Watkins, N. Y. The object here is to provide a pair of scissors with a casing to which one of the scissor blades is secured, the other blade being pivoted to the casing and the first blade and being provided with a slotted arm in which is disposed a pin on a disk journaled for rotating in the casing, so that with the rotation of the disk the scissors will be operated.

**SHEARS.**—W. I. JONES, Watkins, N. Y. The two blades are articulated together, both upper and lower having extensions from the cutting edges of the blades. The extension on the upper blade, which is called a guard, extends upwardly and forwardly relatively to the cutting edge of the said blade, and the extension on the lower blade tapers outwardly from the lower blade and is provided with an enlarged rounded forward terminal.

**SASH BALANCE AND LOCK.**—G. R. KETNER, care of C. E. Miller, P. O. Box 1026, Phoenix, Ariz. The object here is to provide a combined sash balance and lock simple in construction, durable in use, and readily and easily operated. Means provide for balancing the sashes in all positions of adjustment and for immediately relocking the sash through the action of a spring which returns the parts to the positions desired.

**PORTABLE LAWN AND GARDEN SPRINKLER.**—G. J. NIKOLA, 187 Vanderbilt Ave., Brooklyn, N. Y., N. Y. The invention relates more particularly to that type of sprinkler in which a plurality of spraying nozzles are em-



PORTABLE LAWN AND GARDEN SPRINKLER.

ployed, whereby a large area can be sprayed at one time, the water being discharged from the apparatus in the form of a fine mist, so that the ground and vegetation will be moistened in a manner closely approximating nature.

## Heating and Lighting.

**FLASH LIGHT.**—W. S. MCGUIRE, Shady-side, Ohio. This invention provides an automatic contrivance whereby the intensity of the light produced by the flash can be modified by reflectors and screens. It also provides a flash light for use in photography which has a source of light for indicating the light effect that the flash will produce when set off.

**SIDEWALK SKYLIGHT.**—H. DE CORDOVA L. No. 34 (Bajos) Vedado, Habana, Cuba. Among the objects of the invention is to provide a sidewalk skylight construction which is adapted to provide not only light but ventilation, but without subjecting the basement or subway to the unsanitary conditions usually accompanying ventilating devices heretofore proposed.

**ARTIFICIAL FUEL AND METHOD OF MAKING THE SAME.**—E. J. BARCROCK, College of Mining Engineering, Grand Forks, N. D. The invention relates to methods of treating lignite coal, and more particularly is directed to the manufacture of fuel briquets from lignite or other non-coking coal, the principal object being to utilize a low grade, non-coking coal, such as lignite, in the manufacture of a high grade, valuable, and artificial fuel.

## Household Utilities.

**FOLDING CHAIR.**—C. L. CRAIG, Washington Court House, Ohio. A movement of the seat causes the rear supporting legs to open or close, according to the direction of movement of the seat. Means provide for holding the seat in its unfolded or open position, and at the same time exert the proper pressure upon the rear legs to hold the same in their opened position, thereby preventing any possibility of collapse. The principle can be applied to swings, couches, and similar folding articles.

**STOVE.**—G. T. OGLESBY, Frankfort, Ind. This invention relates to stoves suitable for heating dwellings and stores, the more particular purpose being to produce a stove adapted for great economy in the use of fuel, and so constructed that, if made of small size, it does a comparatively large amount of heating.

**GARBAGE CAN.**—E. FRANKKREIBER, 396 Waller St., San Francisco, Cal. An object here is to provide an extremely sanitary garbage

can which can be easily filled and emptied. Also to provide a can having a foot operable chute which may be opened to allow filling of



GARRAGE CAN.

the can, the mechanism for operating the chute being inclosed in a removable housing where it is protected from the elements and the contents of the can, and where it may be uncovered by removal of the housing when it is desired to repair the mechanism.

**WINDOW WICKET OPERATING MECHANISM.**—H. B. GARRE, 979 E. 163rd St., New York, N. Y. The invention provides a locking mechanism to maintain the wicket in closed position; provides a readily-operated mechanism for moving the wicket to open or closed position; provides a means for maintaining the wicket in adjusted position; and provides means for locking the wicket in a number of positions.

**EXTENSIBLE WINDOW SCREEN.**—R. T. BISHOP, Woodhaven, L. I., N. Y. The purpose here is to make screens more attractive in appearance, easier to adjust, and so designed as to be devoid of gaps through which flies, mosquitos, or other insects may enter, as the netting is of one piece with an end rigidly fastened to one section of the screen, and the other end being fastened on a roller mounted in the other section of the screen, whereby the netting is wound or unwound as the screen is contracted or extended.

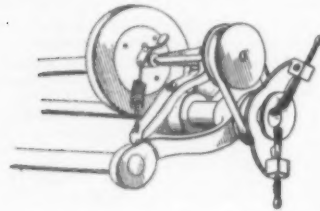
**CLOTHES LINE SUPPORT.**—J. T. PILKINGTON, R. D. No. 4, Armstrong, B. C., Canada. The invention relates to means for supporting a pulley line, and particularly to supporting means adapted to be affixed to the side of a house and to a post, or to two posts or other equivalent uprights. Free space is provided at all sides of the pulleys so that an endless clothes line, with clothes hung thereon, may freely pass, with the clothes, around both pulleys.

#### Machines and Mechanical Devices.

**CLUTCH.**—A. BOSOM, Central Building, Paterson, N. J. The invention relates more particularly to a clutch whereby the transmission from one shaft to another is first obtained by a frictional engagement of means carried by the shafts, and then by bringing in engagement means adapted to transmit positively the motion of one shaft to the other, and thus not depend on the frictional engagement of the parts.

**SPINDLE TESTER.**—P. REILLY, 15 Green St., Worcester, Mass. The object in this case is to provide a tester arranged to permit an operator to quickly and accurately ascertain the efficiency or non-efficiency of the spinning and twister spindles without requiring stopping of the machine or removal of the spools or bobbins from the spindles.

**ATTACHMENT FOR BOTTLE WASHING MACHINES.**—S. MARTINELLI, JR., 229 3rd St., Watsonville, Cal. The invention relates more particularly to an attachment for a bottle washing machine, and one of the principal objects is to provide an attachment for a well-known type of bottle washing machine, by means of which the rust which ordinarily col-



ATTACHMENT FOR BOTTLE WASHING MACHINES.

lects at and adjacent to the crown groove of a bottle neck may be removed, simultaneously with the cleansing of the interior of the bottle. Another object is to provide an attachment including rotary brushes, means for adjusting them, means for attaching them to the machine, and means for driving the brushes from the spindle of the machine.

**MACHINE FOR CUTTING AND PASTING STAMPS TO CIGARETTE BOXES OR ANY OTHER PACKAGES.**—JOSE INABIA, Habana, Cuba. This invention provides means for automatically delivering in separated condition boxes into the path of stamps for enfolding said boxes, and means operating in correspondence with the box delivery for severing and delivering said stamps to an operating station, to be mechanically wrapped about, and caused to adhere to, each of the boxes at said station;

provides a machine wherein the above means are multiplied and united to be operated by a common driving mechanism; and provides means for delivering the boxes after having the stamps applied thereto.

**PROPELLER.**—C. T. A. H. WIEDLING, 124 26th St., Guttenberg, N. J. The invention pertains to rotary propellers for ships, balloons, flying machines and similar vehicles, and it is also of equal usefulness for other devices and machines, as a rotor for steam, water or other fluid turbines, pumps, air compressors, blowers, fans, etc. The object is to reduce vibrations.

**KEYING DEVICE FOR ROLLS.**—W. F. KIRK, care of McLanahan Stone Machine Co., Hollidaysburg, Pa. This speedy and powerful mechanism is especially designed for crushing limestone, and has but one roll, co-operating with a fixed plate, and by means of which the stone may be crushed to varying degrees of fineness in accordance with the adjustment.

#### Musical Instruments.

**GRAPHOPHONE CABINET.**—L. F. CLAWSON, JR., 5 North Nashville Ave., Ventnor, N. J. The cabinet for disk graphophones comprises a lid so combined with the cabinet body and other elements as to be adjustable to form, in effect, a horn or sound intensifier in which the tone volume may be governed by the lid to take the place of shutters, doors, and the like, which frequently are employed to control the volume.

#### Prime Movers and Their Accessories.

**SPARK PLUG.**—A. H. DINGMAN, Allison Park, Pa. The invention relates to spark plugs used in connection with internal-combustion engines. It provides a simple and efficient plug which is light in weight and which is moisture and oil proof. The insulation protecting the



SPARK PLUG.

electrode is so inclosed as not to be affected by moisture of the atmosphere nor by the gases of the cylinder, as certain openings receive enamel which prevents the gases entering the casing or oil working therebetween. The structure, therefore, insures permanency to the spark-plug.

**STAY BOLT FOR BOILERS.**—H. A. LACERDA, 303 Campbell Ave., Schenectady, N. Y. The invention provides a stay bolt for the fire boxes of boilers and like structures and arranged to prevent leakage, to allow expansion and contraction of the bolt without unduly straining the boiler sheets, and to permit movement of the sheets in the direction of their plane without causing shearing or similar injuries to the stay bolt.

**GAS ENGINE SPEED CONTROLLER.**—R. S. ANDERSON, care J. Wade Anderson, Laurens, S. C. This invention relates to internal combustion engines, and more particularly to regulators therefor. It improves and simplifies the construction and operation of regulators referred to so as to be reliable and efficient in use, and easily and quickly manipulated for heavy, no load, and intermediate load conditions with a maximum economy of fuel.

**CARBURETER.**—L. M. FRANCISCO, Baldwinville, N. Y. The invention is more particularly designed to provide satisfactory starting and operation with kerosene as a fuel. Among its objects are: to provide means associated with the nozzle, to heat the latter, and thereby heat the fuel in the passage from the float chamber to the nozzle, as well as to furnish heat for the float chamber itself; and to provide in connection with the air intake a means for utilizing the heat from the exhaust pipe to heat the air in an effective manner.

**DISK VALVE FOR INTERNAL COMBUSTION ENGINES.**—J. S. O'NEAL, care of Munro Hotel, Cincinnati, Ohio. The improvement provides a valve controlling the inlets or outlets of a pair of cylinders of an internal combustion engine and so positioned that the thrust on the valve produced during the explosion or the compression in the cylinder is reduced to a minimum, and also the leakage of gas between the valve and its seat.

#### Railways and Their Accessories.

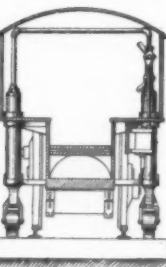
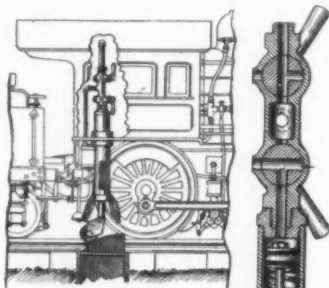
**ROADSIDE DEVICE FOR AUTOMATIC TRAIN STOPS.**—M. C. WRIGHT, 569 West End Ave., New York, N. Y. The invention has particular reference to devices arranged along the railway track or roadbed, and associated with either the switch, signal, or other means for automatically controlling the position of an obstacle adapted to be struck by a locomotive or train device, to prevent an accident should the train for an reason pass a danger signal, or other points, at or before which it should be stopped.

**RAILWAY TIE.**—S. H. HERBST, JR., Fullerton, Pa. One of the main objects here is to provide a tie which insures a resilient seat for rails, which permits the removal of said seats without disturbing the tie itself, which is formed primarily of metal and concrete, which presents an enlarged area of the supporting surface at its under side in the position of each rail, and which provides metal reinforcing plates for the resilient means in order to prevent injury thereto.

**DEVICE FOR REMOVING SNOW, ICE, AND SLEET FROM CHANNELS AND CHANNEL RAILS OF UNDERGROUND RAILWAYS.**—F. J. KRONOTH, 500 W. 150th St., New York, N. Y. This improvement relates to appliance or apparatus adapted for use in connection with underground railways systems, and the object thereof is to provide means for removing snow, ice, and sleet from the channels and channel rails of said railway systems.

**AUTOMATIC TRAIN STOP.**—J. H. PRALL, Innes, Saskatchewan, Canada. The invention resides more especially in the track devices, which comprise a trip adapted to be thrown into position to be engaged by an element on the train, the trip being mounted to be thrown into operative or inoperative position, and to yield to a train passing in either direction, while affording sufficient resistance to actuate the train devices, being usually in the form of means to relieve the air pressure in the train pipe of air brake systems.

**AUTOMATIC SWITCH.**—H. H. PALMER, 64 Columbia St., Charleston, S. C. The invention has reference to means for operating railway switches automatically through the medium of a manually controlled operating device on the



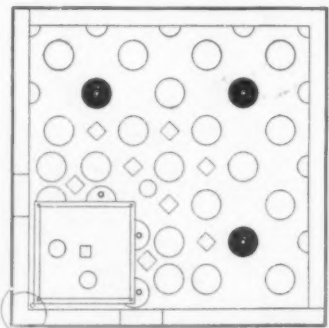
AUTOMATIC RAILWAY SWITCH.

train. In carrying out the invention, use is made of a trip roller adapted to engage plungers arranged in the track, the plungers being arranged to be depressed under the influence of air pressure supplied by the air brake system.

#### Pertaining to Recreation.

**SPINNING DEVICE.**—F. WANKEL, 748 Chatham Square, New York, N. Y. The inventor provides a spinning device for spinning tops, propellers and like articles, and arranged to permit of quickly placing the top or other article in position on the spinning device and to allow of readily actuating the latter with a view to spin the top or to cause the propeller to ascend.

**PARLOR BASE BALL GAME.**—J. STRAUB, care of Blackstone Hotel, Chicago, Ill. In the present patent the invention has reference to a parlor base ball game which is played by the delivery of a missile onto a board representing

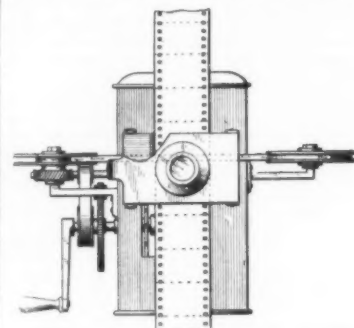


PARLOR BASE BALL GAME.

a playing field, and in which the various features of the ordinary base ball game are reproduced in a manner well calculated to afford amusement without danger to surrounding articles.

**ATTACHMENT FOR MOVING PICTURE MACHINES.**—A. H. F. KURRE, 283 5th Ave., Brooklyn, N. Y. Motion pictures of the future may be shown with the full plot and

description at the same time. By this invention a strip of reading film is shown above the pictures while in motion; thus the story, the conversation, or description will appear above the picture, doing away largely with the necessity



ATTACHMENT FOR MOVING PICTURE MACHINES.

of stopping the picture to show the reading. By means of this invention educational films may be made more valuable because the pictures do not have to be interrupted by reading matter, as both are shown simultaneously. A broad patent has been granted for the U. S. and patents are pending for all the principal foreign countries. A rare opportunity for a capitalist or film producer.

**MOVING PICTURE MACHINE.**—C. A. STOREY, 1124 J Ave., West, Cedar Rapids, Iowa. This invention provides a structure which will cause a proper movement of the film past or through a beam of light by a simple continuous moving structure which may be run at any desired speed, and which will cause the usual stationary period for the film at the right time.

#### Pertaining to Vehicles.

**SPRING SUSPENSION DEVICE FOR VEHICLES.**—J. A. SHEARER, Glen Osmond Road, Parkside, S. Australia, Australia. The invention relates to the suspension or mounting of the frame of a motor car or other vehicle or traveling machine upon its axles by means of levers connected with the axle and pivoted to the frame and adapted to be moved against the action of a spring or springs when said axle is raised relatively to the frame or chassis so as to absorb the shock or jar caused by the passage over rough roads or over irregularities or obstacles. Mr. Shearer has invented another spring suspension device in which each end of the axle is attached to the pivotally connected adjacent inner ends of two longitudinally horizontal links, the outer end or ends of one or both of which is or are pivotally connected to the frame of the car, vehicle, or machine by a lever and spring device which tends to keep the links as nearly as possible in a straight line and to restore them thereto after displacement.

**SPRING.**—E. J. STACEY, 131 North Stone Ave., Tucson, Ariz. The invention provides a spring of the multiple leaf type, wherein the leaves of the spring are separated into series or sections, and so arranged between the vehi-



VEHICLE SPRING.

cle and the running gear that the several series or sections of the spring will come into operation in succession, each succeeding series or section supplementing the action of the preceding series or sections.

**WAGON END GATE.**—C. J. DONAT, Verdigré, Neb. The invention relates more particularly to gates of the type in which the gate is formed of hinged sections, so as to break joint for the convenient placing and removal of the end gate. Means provide for facilitating the manipulation of the gate and its appurtenances, and whereby to hold the gate rigidly when placed in position.

**NOTE.**—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

MUNN & Co.

Patent Solicitors,

361 Broadway,

New York, N. Y.

Branch Office:

625 F Street, N. W.,

Washington, D. C.



## NEW BOOKS, ETC.

**THE DETERMINATION OF SEX.** By L. Doncaster. Cambridge and New York: G. P. Putnam's Sons, 1914.

While the study of sex has not yet reached a stage at which it is possible to give an account of established facts and of generally accepted inferences from them, which shall be free from controversial matter, nevertheless the subject is one which may well be treated in a popular book of this character. The book, however, is more than a completely impersonal survey of the facts; for the author suggests interpretations, which appear to him probable, as well as criticisms of others. The discussion is limited to the problems of sex determination in animals, no reference being made to the work of the same kind which has been done on plants. The book may be heartily recommended as an interesting and instructive treatise.

**EVOLUTION OF SEX IN PLANTS.** By John Merle Cauter, Head of the Department of Botany, University of Chicago. University of Chicago Press, 1915.

This book may be considered, so far as the average reader is concerned, as a supplementary volume to that of Dr. Doncaster, for sex in animals is not discussed in this book, and sex in plants is not discussed in Dr. Doncaster's book. Prof. Cauter's reputation is a sufficient guarantee that he has produced a trustworthy book. He discusses the subject from the standpoint of a sexual reproduction, origin of sex, differentiation of sex, the evolution of sex organs, alternation of generations, differentiation of sexual individuals, parthenogenesis and a theory of sex.

**DIE ROMANTIK DER CHEMIE.** Von Dr. Oskar Nagel, Stuttgart: Kosmos Gesellschaft der Naturfreunde, 1914.

Despite its title this book is not a very romantic discussion of the more important aspects of modern industrial chemistry. Still it serves the useful purpose of presenting in easily comprehended German the essential facts of some very important industries based upon chemical processes.

**TASCHENBUCH DER LUFTFLOTTEN.** Zweiter Jahrgang 1915: Kriegsausgabe. Herausgegeben von F. Rasch und W. Hornel. J. S. Lehmann's Verlag in München.

The war has had its effect upon the publication of the second volume of this most excellent annual. For military reasons it has been deemed expedient by the editors to omit details of the aerial strength of Germany, Austria, and Turkey. The pictures of airships and aeroplanes of those powers which do appear have been published before the war elsewhere. On the other hand, the book gives a very complete survey of the aerial strength of the other powers, and for that reason is most valuable. Indeed, we have found it in actual use in every way most trustworthy.

**DISCOVERIES AND INVENTIONS OF THE TWENTIETH CENTURY.** By Edward Cressy. New York: E. P. Dutton & Co., 1915.

This book deals with the characteristic features of development in certain selected fields of enterprise during the last 25 years. The subjects discussed are the revival of water-power; coal, gas and petroleum; steam power; gas, gasoline and oil engines; generation and transmission of electricity; electric lighting and heating; speed and economy in factory and workshop; foundry and forge; the electric furnace and its applications; the artificial production of cold and its applications; soil and crops; railways; electric traction; motorcars; modern ships; the conquest of the air; wireless telegraphy; ships of war and their weapons; some applications of photography; radium, electricity and matter. Taken as a whole the book must be regarded as a readable and instructive review of technical progress during the period which it covers.

**A SCHOOL ELECTRICITY.** By C. J. L. Wagstaff, M.A. New York: G. P. Putnam's Sons, 1914. 8vo.; 250 pp.; illustrated.

The practical nature of this text at once appeals to the instructor. Every experiment it offers has been actually performed by students in the laboratory or the class-room. This, of course, precludes such subjects as X-rays, telephony, and electric waves. Naturally, a fair equipment of laboratory and lecture apparatus is essential. It is suggested that demonstration by the instructor should largely constitute the earlier lessons, after which the experiments may be repeated by the students. In presenting these experiments the author endeavors to strike the happy mean between insufficient detail and over-elaboration. The examples are very largely original, and a few involve the use of the calculus.

**PROBLEMS OF AMERICAN GEOLOGY.** By William North Rice, Frank D. Adams, Arthur P. Coleman, Charles D. Walcott, Waldemar Lindgren, Frederick L. Ransome, and William Diller Matthew. New Haven: Yale University Press, 1915. 8vo.; 505 pp.; illustrated. Price, \$4 net.

"Problems of American Geology" is a series of lectures commemorative of the life and work of James Dwight Dana, "incontestably"—such is the verdict of Von Zittel—"the first geologist of North America." Inspired by his labors, these lectures briefly present his geology, and proceed to a consideration of American conditions and the questions that arise from them. There are the problems of the Canadian shield, the archæozoic and the proterozoic; there is the Cambrian and its problems in the Cordilleran region; the igneous geology of the Cordilleras also has difficulties that invite an attempt at elucidation, as do the tertiary orogeny and the tertiary sedimentary record. These phases and phenomena of the

science are presented and handled by capable men, who assay the ore offered by the latest discoveries and deductions. They reconstruct the past from its relics in the present, and read the record of the heroic ages as it lies graven in the hieroglyphs of nature's adamantine pages. The illustrations comprise maps and charts, both rare and typical formations, and sketches of bones and interesting restorations. The volume serves to publish a large amount of accurate information that carries light to many of the darker passages of our stratiform records.

**THE PROBLEM OF VOLCANISM.** By Joseph P. Iddings, Ph.D., Sc.D. New Haven: Yale University Press, 1914. 8vo.; 273 pp.; illustrated. Price, \$5 net.

The material of this volume was first prepared as lectures for the Silliman course at Yale University during 1914. It deals with a subject that, involving many of the fundamental problems of geology, is conditioned upon so many conceptions and relationships of the earth and the solar system that its complexity is bewildering. Yet these lectures are couched in language that, avoiding so far as may be technical terminology, presents these conceptions and relationships so clearly that the layman may grasp their essentials. Full page plates of volcanoes abound, while many other such plates show the nebulae in a remarkably clear manner. The physical characteristics of the earth, its petrology and its dynamical status, are incisively discussed, and the extravasation of molten magma, the intrusion of igneous magmas within the lithosphere, and the extrusion of lavas upon the earth's surface, make up the last three lectures. Altogether it is a thoughtful work, presenting its problems forcefully and comprehensively, and handling its speculations in the brightest light that the ablest minds have been able to throw upon this paramount question of physical geology. The hypotheses advanced in explanation of volcanic phenomena are carefully developed, and their modifications under stress of time and wider knowledge are indicated. But it is the problem itself that occupies the author rather than the supposed explanations, and by the aim of a book must the book be judged. From this viewpoint it is distinctly a successful achievement, to be unqualifiedly commended to all students of geology in general or of volcanic activity in particular.

**DIE MILCHSTRASSE.** Von Dr. Friz Kahn-Stuttgart: Kosmos Gesellschaft der Naturfreunde, 1914.

This is a well written, popularly worded treatise on the Milky Way which can be recommended to those who can read German.

**GRAPHIC METHODS FOR PRESENTING FACTS.** By Willard C. Brinton. New York: The Engineering Magazine Company, 1914. 4to.; 371 pp.; illustrated. Price \$4.

The author, eliminating mathematics and technical terms, presents his subject so that the man devoid of any statistical training may readily appreciate and apply the methods. The work is so arranged that the hard-driven legislator, business or social worker may find the section and the chart most nearly related to his needs with a minimum loss of time. In works of an instructive aim, it is becoming more and more customary to show examples of bad practice as well as of good. Certainly, in cases where what not to do is as important as the opposite knowledge, this procedure is helpful in a high degree. Mr. Brinton has followed the practice with good results, accompanying his examples with sound criticism. The field he seeks to cover has so far been neglected by writers and, considering this lack of recorded knowledge, the author has achieved a more than fair measure of success. Among other aspects of the subject, the reader is initiated into simple comparisons, time charts, curve plotting, map representations, curves and records for the executive and corporation financial reports. Anyone desirous of preparing charts for publication will find it easy, with the aid of this handbook, to give the draughtsman a clear understanding of his requirements.

**EFFICIENCY IN THE HOUSEHOLD.** A Book for Every Woman. By Thetta Quay Franks. Garden City, N. Y.: Doubleday, Page & Co., 1915. 8vo. Price, \$1.50 net.

"Efficiency in the Household" is almost wholly a book of chronological forms, two pages to the day, which gives menus for each meal of the day, repeating after three weeks. Below is an order list, with blank spaces under such headings as meats, vegetables, and groceries. At the month's end, the bills and these order lists should agree. On the opposite page may be noted the guests entertained during the day. The menus given, while catering to differing tastes and incomes, are essentially economical. Neither chicken, game, nor the choice cuts of beef are included, and it is estimated that the menus may be served at an average cost of about 21 cents per person. A long preface is full of valuable material, and the compiler aims at combining in the American housewife the common-sense of the English, the thrift of the French, the organization of the German, and the facility of the Italian. A price-list precedes each monthly programme. Ten or fifteen minutes' time daily will suffice to establish the system in any household.

**THE CREATION OF WEALTH.** Modern Efficiency Methods Analyzed and Applied. By J. H. Lockwood. Cincinnati: The Standard Publishing Company, 1915. 8vo.; 225 pp. Price, \$1 net.

"The Creation of Wealth" is meant for the general reader who wishes to grasp, without too intense application, such aspects of the business

world as touch most of us closely. That which has been approached from its practical side by Emerson and Taylor, expounded psychologically by writers like Münsterberg, and discussed from a humanitarian viewpoint by others, is here dealt with in a somewhat different manner. The ingredients of wealth are land, labor, capital, and that elusive element, brain. It is with the last, the most neglected of the four ingredients, that Mr. Lockwood seeks to throw a clearer light upon the whole subject. He attempts an inventory of accomplishment, forecasts the immediate future, and incidentally essays "a working theory of industrialism." His discourse is brightened and strengthened by numerous sketches of famous men and their achievements, and the theories of socialism, of the single tax, and of special privilege are simply presented. Character is made the base of the ideal pyramid of which training and opportunity lead on to efficiency and wealth. The result is a readable and instructive volume worthy of careful perusal.

**STABILITY AND EQUILIBRIUM OF FLOATING BODIES.** By Bernard C. Laws, B.Sc., A.R.C.Sc. New York: D. Van Nostrand Company, 1914. 8vo.; 251 pp.; illustrated. Price, \$3.50 net.

The advent of submarines and aircraft made demands upon our knowledge of equilibrium and stability which that knowledge could not adequately supply. Even now, after years of research and experiment, there is much to discover and to reduce to practice. Mr. Laws's concise work deals with aspects of the subject that have not hitherto been brought together in one volume. He regards floating bodies as subject to active as well as passive forces; he applies the principles of liquid and gaseous pressure both to bodies at rest and bodies in motion. Chapters are devoted to ships, floating docks, submarines, aircraft, and caissons. The author's long study and ripe experience in the scientific side of shipbuilding is freely drawn upon for data and experimental results. Where the subject oversteps his own especial line of research, great effort has been made to maintain the accuracy of the arguments and the value of the deductions. Needless to say, a fair knowledge of rigid dynamics and hydromechanics is necessary to an understanding of this work. For those who wish to pursue the historical side of the subject, or to further develop any branch of this science, frequent reference is made to publications and papers that fill their requirements.

**ON SUNSET HIGHWAYS.** A Book of Motor Rambles in California. By Thomas D. Murphy. Boston: The Page Company, 1915. 8vo.; 376 pp.; illustrated. Price, \$3 net.

In his latest work Mr. Murphy deserts Europe, the scene of his former recorded journeyings on the inflated tire, and turns not unwillingly to the glories of our own California. He is enthusiastic in his appreciation of this "motor paradise," and his glowing word-pictures soon induce a similar state in the reader. To this end the many exceptional colored plates substantially contribute. They are from the works of such artists as Morgan and Moran, while some forty mellow duogravures add their appeal and vitalize the written description. The author promises us that California's good-road mileage will rapidly expand, thus throwing open to the motorist a wealth of romantic history and varied scenic splendor with which few countries can vie. While not a guide-book in the accepted sense, the work will prove a charming and useful companion to the traveler. The State road map showing the principal automobile roads is presented as a folding insert, and adds materially to the practical value of the work.

**TELL-ME-WHY STORIES ABOUT ANIMALS.** By C. H. Claudy. New York: McBride, Nast & Co., 1914. 8vo.; 209 pp.; illustrated with colored plates. Price, \$1.25 net.

A book of fireside tales for children aiming to give them some knowledge of evolution.

**THE ORDINARY PHYSICAL UNITS, MECHANICAL, THERMAL, ELECTRICAL.** By E. S. Elder, Kansas City, Missouri: The Hyde Park Press. Price, 15 cents.

"The Ordinary Physical Units, Mechanical, Thermal, Electrical, Defined, Compared, Correlated," is a small pamphlet of a size to be slipped under the cover of a text book, and thus to be always ready for reference. It will enable one to find any unit and its value with little loss of time. If we were to make any criticism upon it, we should say that it was too much condensed, but in actual use one would soon get accustomed to the arrangement of the matter. The price places it within the reach of classes in schools, especially as liberal discounts are made upon large orders.

**EXPORTERS' ENCYCLOPEDIA.** 1915. Containing Full and Authentic Information Relative to Shipments for Every Country in the World. New York: Exporters' Encyclopedia Company. 8vo.; 1,152 pp. Price, \$7.50.

The eleventh edition of the Exporters' Encyclopedia is a compilation that may not be ignored. It furnishes under one cover just the indispensable information necessary to the man or the firm that ships goods abroad. It offers an alphabetical list of countries, with routes from American ports. It gives the ocean steamship lines and their agents, with freight rates. It discusses the effect of the war upon our export trade and offers suggestions for selling our goods abroad. It gives foreign coinages, and foreign weights and measures, with their American equivalents. Foreign import duties are listed, and custom house

clearances explained. Foreign parcels post and postage rates make up a valuable section. The main body of the text is devoted to the area, population, commerce, products, etc., of the countries of the world, and a list of American consulates in foreign cities is appended. The wide scope of the work, its accuracy, and the accessibility of its contents, make up a desk book that offers hourly aid to the shipper. Monthly "correction notes," furnished free to subscribers, may be inserted in the proper section as they are received, and keep the volume strictly up to date.

**PENNSYLVANIA TREES.** By J. S. Illick, A.B., F.E., Professor of Dendrology and Forest Management, Pennsylvania State Forest Academy. Issued by direction of the Commissioner of Forestry as Bulletin 11 of the Department of Forestry of Pennsylvania, 1914. 231 pages, 103 photographic illustrations and 129 full pages in pen drawings.

This is one of those useful and well-arranged hand-books which are so important to many, and one which has long been required. It is admirably arranged and full in detail, well printed and thoroughly illustrated and is, moreover, to be had for the asking—all great inducements for insuring an extensive distribution among the large class of men and women who are interested in trees and general forestry. The above valuable work can be recommended with real pleasure, because it contains a large amount of extremely useful information in a condensed form. The book is divided into two parts. Part I contains a brief popular discussion dealing with the subject of forestry in a general way. It is intended primarily for the layman and for the beginner of forestry. Among other things, the author discusses the structure, development, protection and value of forests with special reference to conditions in Pennsylvania. He gives also a description of the parts of the trees, such as the bark, twigs, buds, leaves, flowers, fruit, wood, etc., a knowledge of which will enable one to understand the part that follows. Part II is essentially a manual of the forest trees of Pennsylvania. It comprises a discussion on the identification of trees and a description of families, genera, and species with analytical keys. About 130 species of forest trees are described and neatly illustrated by means of pen drawings. By no means the least valuable part of these discussions of individual trees is the information in reference to the properties of the woods and the economic importance of the species. The general get-up of this part of the book reflects credit on the author, and the lay reader who will study it can not fail to gain much valuable instruction.

**STATISTICAL ATLAS OF THE UNITED STATES.** Prepared under the direction of Charles S. Sloane, Geographer of the Census. Washington: Government Printing Office, 1914. 4to.; various paginations.

The cover-title of this work is "Statistical Atlas of the United States 1914," and a portion of the statistical information it contains is brought down to the year 1913. The work is, however, primarily the atlas of the Thirteenth Census, and is based mainly on the statistics of 1910, together with those of the previous decennial censuses when required for the purpose of comparison.

The Statistical Atlas of the United States has been published every ten years since the issue for 1870, though that of 1880 was an unofficial undertaking. It is probably unique among government publications; i. e., no foreign government, so far as we know, presents a corresponding body of national statistics in the same compact and convenient graphical form. Yet this extremely useful work does not appear to be well known to the public; nor, perhaps, to geographers, if we may so infer from the fact that the edition of ten years ago, prepared by the lamented Henry Gannett, received no mention in the leading geographical journals of the world. The new atlas is a collection of more than 500 plates, each of which contains, on an average, two charts or diagrams. Preceding the plates are 100 pages of descriptive and explanatory text. About half the work is devoted to statistics of population. Under this head are given, *inter alia*, a series of national and State maps showing the density of population throughout the country, and the fluctuations of the same from decade to decade. A considerable amount of space is given to the somewhat abstract subject of the "center of population" of the United States, and its migrations. In 1790 this point was 23 miles east of Baltimore, Md., while in 1910 it was at Bloomington, Ind. We also have in this edition, for the first time, information concerning the centers of population of the several states with their migrations since 1880, and statistics as to the past and present location of the centers of negro population and foreign-born population. Other demographic statistics presented in the charts and graphs relate to such topics as illiteracy, immigration, marital condition, sex distribution, etc. The next section of the work is devoted to agriculture, including charts showing the distribution of a wide range of crops, rural industries, economic conditions in connection with rural population, etc. Here, again, we have individual State maps, as well as maps of the country as a whole. The remaining groups of maps and diagrams pertain to manufactures, mines and quarries, cotton, financial statistics of cities, vital statistics, religious bodies, marriage and divorce, and insanity. The Statistical Atlas would perhaps be more interesting and many of the facts it now presents would be more readily understandable if it included a group of well-selected physical charts. The only chart of this character in the edition under review is one showing the mean annual rainfall of the United States.



## No Car Can Be Any Better Than Its Electrical Equipment

Electricity is the nerve system of the modern motor car.

Engine Efficiency depends upon ignition.

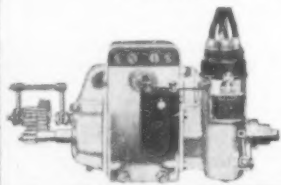
Safety and Comfort and Convenience in driving depend largely upon the cranking and lighting equipment—That is why we say to you first and foremost—make sure that the car you buy is Delco-equipped.

For four years the Delco System has led the way in the development of electrical equipment for gasoline cars.

Today the Delco organization has back of it the experience of over 200,000 Delco equipped cars in actual operation.

It has the largest, best equipped factory in the industry.

It has ample capital and a firm determination to maintain the leadership that has already caused the general acceptance of the Delco System as the world's standard.



The Dayton Engineering Laboratories Company Dayton, Ohio

## REPRINTING BACK NUMBERS OF THE Scientific American Supplement TO BE DISCONTINUED

**Of Importance to Librarians**

The Scientific American Supplement is a unique periodical.

Established in 1876 to describe the exhibits of the Philadelphia International Exposition, it proved so successful that the publishers decided to continue it on broader lines.

Whenever a Tyndall, a Huxley, a Helmholtz, a Pasteur, a Liebig, a Crookes or any other prince of science rose in the learned societies of Europe and announced some new epoch-making discovery of his, his own words appeared in the Scientific American Supplement. The technical papers read by engineers before societies in America—papers too recondite and too long for more popular periodicals—have been given a place in the Scientific American Supplement. Americans who could not read foreign languages found in the pages of the Scientific American Supplement, the utterances of great European physicists and chemists translated into English.

So, in the course of time, the Scientific American Supplement has become a kind of encyclopedia of original scientific sources. It figures over and over again in the footnotes to monographs and scientific treatises; it has played its part in research of all kinds.

As remarkable as the publication itself is the method by which it has been made accessible to the general public. Every number of the Scientific American

Supplement from 1876 to 1915 has been kept in print. What is more, the numbers of 1876 have been sold for 10 cents just as if they were published today. And this despite the fact that publishers of newspapers and periodicals often charge several hundred per cent more for back numbers than for new ones.

The Scientific American Supplement will continue to print the papers of great scientists and engineers as it has in the past. But the policy of reprinting back numbers will be discontinued.

For a few weeks only we shall be able to furnish all the single numbers of the Scientific American Supplement or bound volumes.

This announcement is made for the benefit of libraries in which complete sets of the Scientific American Supplement are not to be found, and for those interested in science who feel a genuine need for an encyclopedia of science of the most diversified kind.

We will supply, free of charge, on request, copies of the Scientific American Supplement Catalogue, in which all the papers that have been printed in the Supplement since 1876 are indexed. This catalogue will not be published in the future.

Order back numbers or bound volumes of the Scientific American Supplement now either from your bookseller or directly from the publishers.

**MUNN & CO., Inc., Publishers, 233 Broadway, New York**

### Notes for Inventors

**Color Photography.**—In patent No. 1,126,689, Rodolphe Berthon and Maurice Audihert of Villeurbanne, France, describe a photographic apparatus for color photography which has an objective for projecting an image and concentric prisms which break the image into monochromes projected through a three color screen onto a sensitized surface.

### Fire-Bucket and Waste-Can Combined.

—George W. Lorimer, of Piqua, Ohio, has patented a combined fire-bucket and waste-can, No. 1,100,837, in which the waste-can and fire-bucket are so associated that the practically daily attention to the waste receiver or can will insure attention to the fire-bucket, so the latter will always be in condition for efficient use.

### Recognition of a Woman's Invention.

In rendering a decision in the U. S. Circuit Court of Appeals Ninth Circuit, Justice Gilbert in Hyde v. Minerals Separator Limited took occasion in referring to the Everson patent No. 348,157 to say "Miss Everson was the first to make the important discovery that the affinity of the oil for the metal was increased by the addition of an acid."

### Chinese Imitation Not Necessary.

—In Bush & Lane Piano Company v. Becker Brothers, 209 Fed. 233, it was held that to constitute an infringement of a design patent it is not essential that the copying design should be a Chinese copy of that of the patent, but it is sufficient if it imparts to the mind the same general idea of appearance and ornamentation so that purchasers might be deceived.

### A Drinking Vessel of Ice.

—Hendrik Douwe Pieter Huizer of The Hague, Netherlands, has patented No. 1,123,537 an apparatus for manufacturing drinking vessels in the form of tumblers of ice, suggesting that besides the cooling effect of the ice drinking vessel there is a further hygienic advantage in that it can only be used once, also that the life of the vessel can be lengthened by insulating it thermally by a paper or celluloid case, also by giving it a special form and using special precaution in making it.

### Two Patents for Newspaper Improvements.

—Edgar H. Cottrell, of Westerly, R. I., has secured two patents No. 1,126,405 and No. 1,126,406 for newspapers. In No. 1,126,405 one page of the newspaper is printed on one side of one sheet and another page is printed on one side of another sheet and the remaining pages are each printed partly on one sheet and partly on another sheet, the idea being to avoid the difficulties in holding the paper as usually printed when unfolded. In No. 1,126,406 the newspaper has its assembled leaves secured together along a line extending transversely across the middle of the printed pages and the printed matter is so arranged that the first half of the paper may be read from front to back by turning the leaves over in one direction and the remaining half of the paper may be read from back to front by reversing the paper and turning the leaves over in the opposite direction.

### Specifications and Drawings of Patents.

—According to the monthly catalogue of the Superintendent of Documents, the bound volumes of patent specifications and drawings constitute the largest series of public documents thus far issued by the United States Government. They were first published in weekly volumes, beginning May, 1871; August, 1872, the form was changed to a monthly volume; July, 1885, the issue of semi-monthly volumes began; while since January, 1903, three volumes a month have been issued, many of them being very bulky. By virtue of the Sundry Civil Act of August 24th, 1912, this series is to end with the three volumes corresponding to June, 1912; but the publication is much in arrears, and has now only reached June, 1911. The whole series will include 974 books, mostly of mammoth size, filling about 350 feet of shelf-room. Although the issue of bound volumes has been discontinued, the specifications and drawings of patents will continue to be printed in "slip" or pamphlet form and sold by the Patent Office.

### LEGAL NOTICES



INVENTORS are invited to communicate with Munn & Co., 361 Broadway, New York, or 625 F Street, Washington, D. C., in regard to securing valid patent protection for their Inventions, Trade-Marks and Copyrights registered. Design Patents and Foreign Patents secured.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing as with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our Hand-Book on Patents will be sent free on request.

Ours is the Oldest agency for securing patents; it was established over sixty-five years ago.

All patents secured through us are described without cost to patentee in the Scientific American.

**MUNN & CO., 361 Broadway, New York**  
Branch Office 625 F St., Washington, D. C.

## Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

### AGENTS WANTED

AGENTS. 500% Profit. Free Sample Gold and Silver Sign Letters for store fronts and office windows. Any one can put on. Big demand everywhere. Write today for liberal offer to agents. Metallic Letter Co., 438 N. Clark St., Chicago, U.S.A.

### BUSINESS OPPORTUNITIES

WANTED.—To buy patents for articles that will have large sale and can be retailed at from 10 cents to \$5.00 each. For further particulars address Sales, Box 773, New York.

### FOR SALE

\$1 to \$500 EACH paid for hundreds of U. S. and Foreign Coins dated before 1895. Send 10c at once for Illustrated Coin Value Book, 4x7. Get posted. Charlie Coin Co., Box 155, Le Roy, N. Y.

### PATENTS FOR SALE

PATENTS FOR SALE, covering a small portable machine operated by hand for attaching hooks and eyes to cloth, using hooks and eyes of metal strip stamping which are automatically fed from a magazine. Also patent covering rotary "expansion ring" packed valve for automobile motors. E. Paul du Pont, Montchanin, Del.

PATENT FOR SALE, United States. Combined Table and Ironing Board. Address, for terms and further particulars, John Jasus, 811 Louis Street, Strevator, Ill.

INVENTION IN NOVELTY LADIES' HAT fastener; no points extending through hat. There for protection; holds hat firmer to head, doesn't puncture hat full of holes, easily changed from one hat to another. Manufacturing with dies, very cheap; metals, celluloid. A great mail-order novelty. Patent rights in United States for sale or royalty. O. Thielenshaus, 2337 Putnam Ave., Brooklyn, N. Y.

### WANTED

WANTED. Patent right salesmen to sell Township rights to valuable invention. Liberal commission. Must be able to handle Town Boards to effect sales. Exclusive territory if desired. Box 96, Penn Yan, N. Y.

Just Out

## A-B-C OF GARDENING

By  
**EBEN E. REXFORD**

Here is the manual for the man or woman who sighs to have growing things about, but who is bewildered by the numberless directions of so many volumes on the subject. This book contains all the information necessary for starting and keeping in order an outdoor flower-garden or indoor plants. The instructions are so simply given and so specific that no reader who follows them could fail to make his garden a success.

Among the chapters are: Making the Garden; The Border; Annuals; Vines; Midsummer in the Garden; Window-Boxes; Growing Plants for Table Decoration; The Bulb-Bed; Bulbs for Winter Flowering; Getting Ready for Winter; Insect Enemies; Gardening for Children; Don'ts.

50 cents net

**HARPER & BROTHERS**



### Welding Water and Gas Mains

(Concluded from page 272.)

sible, to make the joint stronger than the tube by the simple procedure of adding a thick layer of new metal.

It might be thought that ruptures would occur because of expansion and contraction under variations in temperature. To settle this question, a severe experiment was tried in England. A long length of welded pipe was provided with a heavy concrete abutment at either end, the interior was put under a pneumatic pressure of 100 pounds per square inch and a daily fluctuation of temperature through a range of 80 deg. Fahr. provided for a period of one month. At the end of the time the joints were still intact.

In laying pipes by the new method, it is often convenient to join up a long straightaway section on the surface of the earth and then roll or slide it into place in the bottom of the ditch. In welding the joints of straightaway sections, it is sometimes possible to elevate the portion at the end where the new joint is to be made. That is, a support will be put under this end and a little farther back another but lower support. As the welds are made, the two supports are advanced and the line settles down on the earth to the rear. Another method is to weld the pipe at the surface, but supported over the ditch by cross pieces of wood.

At times joints are made after providing a working space by excavating beneath the pipe as it lies in final position at the bottom of the ditch. Such excavations are especially required where two sections have to be joined which have already been made up by a more convenient procedure, or where there is an angle or a complicated system of joints.

It might be thought that the new molten material could be allowed to flow down to the lower side of the pipe and automatically make the joint without especial assistance from the workman, but this is not the case. When two such refractory metals as the steel of the pipe and the Norway iron of the welding rod have to be joined, both must be at or near actual fusion at the surfaces of contact, and the weld must be made little by little. No "wholesale" procedure is applicable in this process. When a long length is to be welded up on the surface it is often possible to avoid welding underneath. The welder operates continually at or near the upper side of the joint, while helpers roll the pipe slowly over.

In making the welds, it is not necessary to have bell and spigot ends, but one edge is brought up to the other. If they have been properly prepared by beveling at an angle of 45 degrees a 90-degree groove will thus be formed, but jointing is not necessary. Square edges may be welded, butt to butt, provided a small interval is left between the two edges to provide access for the welding flame. Where the metal is thin no interval is required, as the flame will heat the metal all the way through.

A foreign invention provides a special joint. The two pipe ends which are to be welded are arranged to telescope for a short distance, the surfaces of contact being conical, so that it is possible to get a fairly tight joint by purely mechanical means. The edge of the larger end is rather sharply flared, thus providing an annular space for the new metal added in the welding procedure. When welded in this way the joint is particularly strong and impermeable.

Whenever welded lengths are to be put into the ditch it is not necessary nor altogether desirable that they should be handled with excessive care. A little roughness has the advantage that it provides a test before the pipe is covered up. If the joints fail, it is preferable to know of the weakness at once, when correction is a simple matter.

Gas welding has been employed in making joints where pressures were excessively high. The steel pipe line serving a hydro-electric power house in one of the Western States developed leaks soon after the water was first turned on. The pipes were large, the metal thick, and the pressures ran up to 800 pounds per square inch. The leaks were numerous and seri-

ous. In fact, if gas welding had been unequal to meeting the difficulty, a considerable section of line would have been a failure. The seams were made by riveting straps of steel over the butt joints between edges of steel plates. The seams made in the shop were good; those made in the field were defective. By means of the oxy-acetylene blowpipe, the joints were made strong and tight. This work was done without removing the pipe from its bed.

Here, too, expansion and contraction seem to have produced no real trouble, and yet some of the lengths involved were considerable. Steel expands or contracts about 0.0000066 along its linear dimensions for each degree Fahrenheit. A thermal variation of 50 degrees would, in the case of a 100-foot length, add or subtract 2/5 inch, and we might expect serious results from such movements. However, the fact that a pipe is fairly free along two dimensions is probably the reason why it may be held fast along the third. Whether railway rails may be joined together and made into a single piece is a very similar question, and just as interesting.

### Methods by Which the European War Has Been Filmed

By Ernest A. Dench

IN taking pictures at the front, the motion picture camera man has been confronted with no ordinary task. He is exposed to as many risks as the soldiers themselves, not counting the fact that he is greatly resented by the warring powers, who place various restrictions in his way.

Cherry Kearton made many attempts to film exploding shells at the Battle of Alost, but he found that they were barely noticeable on the screen—there is a flash and that is all. When one strikes a poor soldier he slips forward a little and stirs no more. Mr. Kearton states that if there are dense volumes of smoke and the soldiers fling their rifles up in the air, then die in a pose, such films are fakes. In warfare to-day smokeless powder is the only kind used, it being in universal demand because it does not give their position away to the enemy.

The operators of a well-known French company had their cameras equipped with a telephoto lens, by the aid of which it was possible to cinematograph soldiers at work in the trenches at a distance of six hundred yards. By this means they could get close range views of the fiercest fighting; the ordinary lens is limited to a range of two hundred feet.

Most other camera men have dispensed with the cumbersome motion picture machine and instead used an aeroscope camera, which is minus a tripod and, therefore, easy to carry about. But even this does not frighten all the difficulties away.

To keep the camera steady when carrying out his work Mr. Mason was obliged to adopt sundry plans. The most successful one was to strap the camera to the trunk of a tree, which, also afforded protection for the operator. At another time, wanting to obtain pictures of the Belgians fighting in the trenches, Mr. Mason laid himself flat in the middle of the street and held the camera up in front of him.

His one great scoop was a set of remarkable panoramic views of the German army. To photograph these he attached a coil of wire to the machine, tying the other end to a button on his coat. He then climbed up a telegraph pole, and after reaching the top he tugged at the wire and thus got the camera up safely. The final operation was to hold it tightly and focus the camera on the magnificent sight ahead of him.

M. Bizeul hit on the ruse of employing the second-story room of a restaurant opposite the Ghent town hall. He opened the window just wide enough to permit the lens to pass through, and when the Germans did arrive he filmed continuously from 3 o'clock to 4:15 in the afternoon.

The greatest task of all is getting the stuff past the censor at the front, who hacks the film to pieces unmercifully. Smuggling, therefore, is often resorted to and many are the methods by which the officials are dodged. Paul Rader, a plucky



*"I tell my customers that J-M Responsibility goes with J-M Roofing long after I'm gone"*  
(Signed) Charles H. Wheelock  
Battle Creek, Mich.

*"J-M Service," says this J-M dealer "makes J-M Roofs practically good as new when other roofs are gone. I have been putting them on steadily for years and they are all still good."*

## Your Roof is our Responsibility

—because a J-M Roof, when registered with us, is permanently in our care—backed up by over half a century of recognized business integrity.

No matter what kind of roof—factory, house barn or shed—J-M Responsibility stands under it to the last. We won't let you be dissatisfied with J-M Roofing. It must be right.

J-M Responsibility means a way of doing business—stronger than the guarantee of materials we give you—better than any "scrap of paper" ever signed.

J-M Roofing on your roof makes it our roof, too. We see to it that it makes good to you—that its service to you serves our reputation.

J-M Asbestos Roofings are examined by Underwriters' Laboratories (under the direction of the National Board of Fire Underwriters).

J-M Roofing Registration is a new and additional feature of J-M enterprise that gives J-M Roofing buyers a positive guarantee of roofing service.

We want every buyer of J-M Roofing to register his roof with us. Then we can see that you get J-M roofing service rendered from your roof as thousands of other J-M roof owners are getting it from their roofs.

Tell us what kind of roof you have to cover and we will send you Roofing Literature that will solve your roofing problems right.

# J-M ROOFING

## Responsibility


Write us About YOUR Roof

|                          |            |               |            |             |           |               |              |            |                |                |              |
|--------------------------|------------|---------------|------------|-------------|-----------|---------------|--------------|------------|----------------|----------------|--------------|
| H. W. JOHNS-MANVILLE CO. |            |               |            |             |           |               |              |            |                |                |              |
| Akron                    | Buffalo    | Chicago       | Cincinnati | Dayton      | Galveston | Kansas City   | Milwaukee    | New York   | Portland, Ore. | Seattle        | St. Louis    |
| Albany                   | Atlanta    | Baltimore     | Birmingham | Columbus    | Dallas    | Duluth        | Indianapolis | Louisville | Memphis        | Minneapolis    | Omaha        |
| Boston                   | Butte      | Camden, N. J. | Chicago    | Cincinnati  | Dayton    | Galveston     | Kansas City  | Milwaukee  | New York       | Portland, Ore. | Seattle      |
| St. Paul                 | Washington | Wichita       | Yonkers    | Albany      | Atlanta   | Baltimore     | Birmingham   | Columbus   | Dallas         | Duluth         | Indianapolis |
| Louisville               | Memphis    | Minneapolis   | Omaha      | New Orleans | Pittsburg | San Francisco | Youngstown   | Albany     | Atlanta        | Baltimore      | Birmingham   |

THE CANADIAN H. W. JOHNS-MANVILLE CO., LTD., Toronto, Winnipeg, Montreal, Vancouver

## Esterbrook Pens

250 styles



To those who use a pen only occasionally, Esterbrook Pens are the most pleasant and satisfactory assistant; to those who write constantly, an invaluable ally and friend.

Backed by half-century's reputation.

SEND 10c for useful metal box containing 12 of our most popular pens, including the famous Falcon (48).

Esterbrook Pen Mfg. Co.  
New York Camden, N. J.

Ask your stationer

## VENUS PENCILS

Made in 17 degrees (6B softest to 9H hardest) of never varying, uniformly graded quality, also 2 copying. Ask for free trial sample and booklet.

American Lead Pencil Company  
317 Fifth Ave., New York

## 50 Light Dynamo

\$55 in payment of \$5 per month

Send for Circular  
HOBBART BROS. CO.  
Troy, Ohio

## MILL and FACTORY FIRE ALARM SYSTEMS

We are prepared to furnish a complete line of this apparatus WRITE FOR PRICES

The Holtzer-Cabot Electric Co.  
BOSTON CHICAGO

## "Glasses can be made becoming—"

It's simply a matter of the right selection. With our complete stock of high grade American Optical Company lenses and mountings I'll make glasses a great deal more becoming to you than tired, strained eyes."

Ask your oculist, optometrist or optician—he knows.

AMERICAN OPTICAL COMPANY  
Southbridge, Mass.

Largest Manufacturers of Spectacles, Eyeglasses and Lenses in the U.S.



## VEEDER Counters

register reciprocating movements or revolutions. Various designs for fit machines in almost every line of business. Probably there is one just suited to your needs. Booklet free.

Veeder Mfg. Co.  
18 Sargeant St.  
Hartford Conn.

## LEARN TO BE A WATCHMAKER

Bradley Polytechnic Institute—Horological Department

Formerly the largest and best watch school in America

Peoria, Illinois

We teach Watch Work, Jewelry, Engraving, Clock Work, Optics, Tooling, mensurable. Board and room near school at moderate rates. Send for Catalog of Information.

## What the Small Manufacturer Needs

THE largest companies have organized Patent Departments, which are as important—if not more so—than the manufacturing force. Their salaried patent experts analyze new ideas produced by research engineers and chemists, secure the fullest measure of protection, and determine whether the idea is worth protecting. They save the waste of re-inventing what is old; they study new and patentable ideas and work hand in hand with the Research Department.

A thousand questions must the experts answer: Is an invention anticipated by prior patents? Can changes be made in the invention which would avoid infringements? If so, what changes? Is the prior anticipating patent or patents valid or not? Who owns the patent which protects a rival product, which seems to be capable of development?

Such questions arise, not only in the business of the large corporations, but of the small manufacturer as well. Because he cannot afford to maintain an expensive staff of patent experts with their assistants, stenographers and draftsmen, he has sometimes seen his business slipping away from him into the hands of a wealthier rival.

The firm of Munn & Co. have instituted a patent service for the small manufacturer, which is designed to give him all the facilities which are now enjoyed by the large manufacturing corporation. Patent experts, many of whom were formerly connected with the United States Patent Office and are specialists in their various lines, will study your products. They will ascertain whether or not adequate patent protection has been, or can be obtained; they will compare from the patent standpoint all the products of the same class now on the market, and determine if it is not possible to effect a profitable combination; they will critically compare your product with that of your rival. In a word, they will see to it that your ingenuity—the most vital asset of your business—is adequately protected.

FOR FURTHER INFORMATION, ADDRESS

**MUNN & CO.**

SOLICITORS OF PATENTS

Manufacturers' Service Department

361 BROADWAY

NEW YORK CITY

American, managed to film pictures of an artillery duel between the French and Germans, after which he rushed to the nearest vacated house and hid both camera and film in the cellar. A few days later, when the fighting had shifted to another part of the country, he returned for his belongings and was successful in eluding the vigilance of the authorities on his journey to the coast, en route for England.

### The Current Supplement

IN Modern Ideas of the End of the World, in the issue of the SCIENTIFIC AMERICAN SUPPLEMENT for March 20th, No. 2046, readers will find an able review of theories, and a valuable contribution to cosmology that is full of interest not only to every physicist, but all well-informed people. Gasoline from "Synthetic" Crude Oil will be especially acceptable at this time when so many are engaged on problems relating to the fractional separation of petroleum, as it tells of some remarkable experiments on a process by which a considerable additional yield of gasoline was secured. The Gardens of the Zoological Society of London, with its pleasing illustrations, gives something of the history and organization of a celebrated institution. A New Era in the Science of Nutrition tells about an important work by noted specialists that is of interest to everyone. The Cutlery Works at Thiers tells a readable story, with illustrations, of the methods of manufacture at one of the oldest and most important cutlery centers in Europe. The Reactions of the Planets on the Sun discusses the influence exerted by the earth, and considers the question of sun-spots from a new point of view. The article on Gyrostatic Reaction is concluded; and there are the usual assortment of valuable short articles, including some account of recent developments in X-ray tubes, hydrogen and the rare gases and conditions of industrial accidents. A number of valuable new books are also described.

### Finger Prints in the Army

THE last report of the Adjutant-General, United States Army, contains interesting information as to the use of the finger-print method of identification in the army, including some striking instances of the utility of this method. To the end of the last fiscal year a total of 291,181 finger-print records had been received in the Adjutant-General's office, of which 88,937 were made in cases of reenlistment, when the records made during previous service were already on file. It is found necessary to obtain finger-print records of men claiming previous service, for the purpose of detecting cases, several of which have been discovered, in which a man with a discharge certificate in his possession claimed the service represented by, and enlisted under the name appearing in, that certificate, although his finger-print record established beyond a doubt the fact that he was not the man he claimed to be. During the fiscal year 467 cases of fraudulent enlistment of former deserters, general prisoners and others were discovered through the finger-print system. The office has also identified by means of this system dead men who were former soldiers and whose identity could not be satisfactorily established in any other way, as well as civil offenders who sought to evade arrest by enlisting in the army under assumed names, and soldiers who left impressions of their fingers while in the act of committing serious offenses.

**Keeping the Eye on the Golf Ball.**—In patent No. 1,126,051 the inventor provides for preventing the player from raising or turning his head and thus forcing him to keep his eye on the ball by supplying a harness in which an anchor member in the form of a strap or band encircles the chest and an elastic tube projects therefrom and is held by the teeth of the player so that when he starts to move his head to one side or the other, he will feel the pull on the elastic tube and will be reminded of the fact that he should face to the front and keep his eye on the ball. Apparently golf isn't hard enough.



## Just Fifteen Minutes at Bedtime

IN only those few minutes a day it is possible for you to get the knowledge of literature, the broad culture, that every University strives to give.

This is no idle promise. Dr. Chas. W. Eliot, from his sixty years of reading, study, and teaching—forty years of it as President of one of the world's greatest universities—has put aside those few great Poems, Dramas, Biographies, Histories, Works of Travel, Science, Philosophy, and Religion that best picture the progress of the human race from the earliest times down to the present day.

"I believe that the faithful and considerate reading of these books will give any man the essentials of a liberal education, even if he can devote to them but fifteen minutes a day."—Eliot.

What books? The answer is contained in the free booklet mentioned below; it is the most valuable booklet ever written for the man who wants advice on what or how to read. It contains the story of

## THE HARVARD CLASSICS

The Five-Foot Shelf of Books

Published & Sold only by P. F. Collier & Son

One hundred thousand business men are using the pleasant, helpful reading courses therein laid out. They are reading the great histories, seeing the great plays, hearing the great orations, meeting the great men of history.

### A Free Booklet For You

We want to send you by mail this "Guide Booklet to Books," absolutely free.

It is the most valuable little booklet of its kind that has ever been written. It shows how to select a library without waste or worry—just what books are most worth while. It contains the advice of the leading educator of his day on what and how to read. No obligation; merely clip the coupon.

Masterpieces Sold Cheaper Than Fiction

S. A.

2015

P. F.

COLLIER

& SON

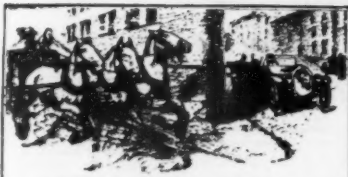
416 W. 15th St.,

New York

Name .....

Address .....





## No Danger—If the Brakes Hold!

How long since you've really put your brakes to an emergency test? Just slowing down easily is not *real test*.

It's when you jam down the foot-brake, jerk back the emergency-brake and feel your heart coming up into your throat that your brakes are really proven.

Brake power depends entirely on the gripping friction of the brake lining. If the lining is shy of friction or gripping power, your brakes will fail in the crisis and you are *wholly to blame!*

## Thermoid HYDRAULIC COMPRESSED Brake Lining - 100%

Thermoid is honest brake lining all through. There's the same gripping friction at the core as on the outside. It is forced by hydraulic compression into a substance of uniform density and, though worn paper-thin, it still grips and holds instead of being loose and stringy inside with just a thin friction surface, like the ordinary, loosely-woven brake lining.



Watch your brake lining—guard your safety with 100% Thermoid

Thermoid Rubber Co.

Trenton, N. J.

Our Guarantee—Thermoid will make good, or we will.

Cannot be burned out nor affected by oil, heat, water, gasoline, dirt

## RUN THIS ENGINE for 30 DAYS FREE

Detroit Kerosene and Gasoline engines sent YOU on 30 days FREE TRIAL. Guaranteed 10 years. Economical horse power, lowest prices; farmer agents wanted everywhere. Engine operates on gasoline, kerosene, alcohol, distillate or naphtha. Saws wood, grinds feed, churns, pumps, separates, makes light any job around the farm. Only \$2.50 moving parts, no cams, gears, sprockets, etc. Send for "Common Sense Power Book." 2 1/2 Detroit Engine Works, 127 Bellevue Ave., Detroit, Mich. 503

## CAILLE Speed Motor

Push-Button Control. Gives two forward, a neutral and two reverse speeds, by simply pressing a button. Magneto enclosed in fly-wheel. Dual ignition. Silencer on exhaust. Water-tight gear housing and six other exclusive features. Send for catalog No. 10. We also build marine motors from 2 to 30 h. p. If interested, ask for catalog No. 24. The Caille Perfection Motor Co., 1829 Caille St., Detroit, Michigan.

## We Save You The Price of a Boat On Your Outboard Motor

Why pay \$70 or \$80 for a motor not one whit better than the American at \$44.95? It embodies just as good materials, workmanship and design. We sell cheaper because of big production and the fact that American Motors Are Sold Direct saving you dealers' profits. The American gives 2 h. p. Runs 6 to 9 miles an hour. Adjustable for stern. Reversible. Weighs about 50 lbs. Steers with propeller. Also has rudder steered motor. Magneto ignition at small cost. Ask for catalog "B." American Engine Co., 611 Boston St., Detroit, Mich.

## 30 DAYS FREE TRIAL

and freight prepaid on the new 1915 "RANGER" bicycle. Write at once for our big catalog and special offer. Marvelous improvements. Extraordinary values in our 1915 price offers. You cannot afford to buy without getting our latest propositions. WRITE TODAY. Boys, be a "Rider Agent" and make big money taking orders for bicycles and supplies. Get our liberal terms on a sample to introduce the new "RANGER." TIRES, equipment, sundries and everything in the bicycle line half usual prices. Factory prices on Motorcycle and Automobile Supplies. MEAD CYCLE CO., DEPT M-175, CHICAGO.

## Notes and Queries.

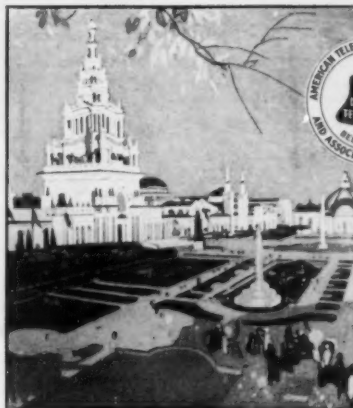
Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13049) C. L. C. asks: Has there ever been a motor constructed by using permanent magnets as motive power, or does this come under the head of perpetual motion? A. There never has been a motor constructed the power for which was obtained from permanent magnets. Nor is it likely that such a motor will ever be built: since one pole of a magnet attracts and the other pole at the same instant repels with an equal force, their resultant force is zero. Since it is not possible to make a magnet with only one pole, it is impossible to get rid of this equal attraction and repulsion of two poles. A magneto whose field was made by permanent magnets was in use before the dynamo was invented. The telephone ringer is such a machine, and a motor with permanent magnets in the field and a commutated current in the armature was also devised long ago. Such a motor would certainly be a perpetual motion machine, if it did work without any supply of power outside of itself.

(13050) J. A. F. asks: Please answer the following query: The saliva in the mouth being an alkali, and the stomach juices being acids, and as alkalies counteract acids (also *vice versa*), how is it that it is generally recommended by most physicians to mix food thoroughly with saliva before swallowing? A. The saliva has a two-fold action in digestion. The first is to moisten the food and to assist in forming dry food especially into boluses so that it can be easily swallowed. The second action is chemical, in which the carbohydrates of the food have the first act of digestion performed upon them. The starches are first broken down into dextrine and then into maltose. Thus the first step in digestion takes place in the mouth, and it is a very important step too. Thorough chewing of the food is important in order to mix the saliva thoroughly with the food and it gives it time for its peculiar action before the food passes on to the gastric stage of digestion. Saliva is but slightly alkaline.

(13051) E. B. H. asks: 1. Can you answer the following questions in your Notes and Queries Department to settle an argument? Compressibility of sea water compared with solid steel. (I figure the elastic modulus of sea water to be 294,000, which would cause sea water to be dense enough to hold solid steel suspended at the bottom of a suppositional pit in the ocean, 110 miles below the surface.) A. Sea water is compressed  $44 \times 10^{-4}$  per atmosphere, according to the Smithsonian Physical Tables, page 83, which we will send for \$2 postpaid. At the bottom of the ocean in the deepest place known this would give a density about 1.20 greater than at the surface. There are no places as deep as 110 miles in the ocean. The Nero Deep is 31,614 feet, and the Planet Deep is 32,086 feet, or 406 feet more than 6 miles. No place has been found where the sounding wire has not reached the bottom. We may feel reasonably certain that we know the depths of the ocean. The recent book by Murray, "The Depths of the Ocean," which we will send for \$7.50 postpaid, gives the story of the searching of the ocean for the facts of its history. We may reasonably dismiss the discussion of a "supposititious pit" in the ocean. By the same authority referred to above, steel is compressed  $68 \times 10^{-4}$  per atmosphere, or more than 50 per cent more than water at the same pressure. Therefore, as a solid steel ball should descend in the water it would be compressed half as much again as the water at the same depth. You can see that there could be no depth at which water would become as dense as steel, and therefore no place where a steel ball would remain in suspension in the ocean, even if there were a pit reaching to the center of the earth. 2. Is the pressure sufficient to collapse the best braced ship before the water itself becomes dense enough to hold the ship suspended? That is, is a ship with hatches tightly closed, and bulkheads hermetically sealed, bound to sink to the bottom of the ocean, provided it is heavy enough to sink when say 100 feet below the ocean surface? A. The density of sea water averages 1.025. This would cause an increase of pressure of one atmosphere for each 33.17 feet of descent. At the bottom of the Planet Deep the pressure is almost 1,000 atmospheres, or about 7 1/2 tons per square inch. It is safe to say that ordinary bracing of a compartment containing air could not withstand this pressure. Another inference which we have often stated in Notes and Queries is that anything which sinks at the surface of the water will go to the bottom anywhere in the ocean. Nearly everything is more compressible than water. Glycerine and mercury are the only materials given in the Smithsonian Tables which are less compressible than water. Of course there may be other liquids not yet measured, but it is very unlikely that there are any solids less compressible.

(13052) T. E. P. asks: 1. Suppose a train going at the rate of 60 miles an hour. If a bird were liberated inside the car, and just simply remained stationary, fluttering his wings as they often do, would it remain in the same position, or would the end of the car strike it? A. If the windows and doors of a car are closed, the air



## Creating a New Art

At the Centennial Exhibition at Philadelphia, the exhibit of the Bell System consisted of two telephones capable of talking from one part of the room to another.

Faint as the transmission of speech then was, it became at once the marvel of all the world, causing scientists, as well as laymen, to exclaim with wonder.

Starting with only these feeble instruments, the Bell Company, by persistent study, incessant experimentation and the expenditure of immense sums of money, has created a new art, inventing, developing and perfecting; making improvements great and small in telephones, transmitter, lines, cables, switchboards and every other piece of apparatus and plant required for the transmission of speech.

As the culmination of all this, the Bell exhibit at the Panama-Pacific Exposition marks the completion of a Trans-continental Telephone line three thousand four hundred miles long, joining the Atlantic and the Pacific and carrying the human voice instantly and distinctly between New York and San Francisco.

This telephone line is part of the Bell System of twenty-one million miles of wire connecting nine million telephone stations located everywhere throughout the United States.

Composing this System, are the American Telephone and Telegraph Company and Associated Companies, and connecting companies, giving to one hundred million people Universal Service unparalleled among the nations of the earth.

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY AND ASSOCIATED COMPANIES

One Policy

One System

Universal Service

## "YANKEE" Ratchet Breast Drill Right- and left-hand Ratchet Double right-hand Ratchet

No. 1555—3-jaw chuck  
No. 555—2-jaw chuck  
Price, \$5.25



## "YANKEE" TOOLS

Make Better Mechanics

Five adjustments, made with Shifter between the small gears:  
(1) Plain drill; (2) Left-hand ratchet; (3) Right-hand ratchet; (4) Double ratchet; (5) Gears locked.

Your dealer can supply you. Write for "Yankee Tool Book" for mechanics and householders, or for "Yankee Tools in the Garage" for motorists.

NORTH BROS. MFG. COMPANY, Philadelphia

## INVENTORS! —"Let Us Be Your Factory"

We manufacture Special Machinery, Patented Metal Specialties of all kinds. Electric Articles, Hardware, Contract Manufacturing, Development, Sample Work. You get the advantage of our splendid equipment, up-to-date methods and wide experience. We Do It All. Tools, Dies, Stampings, Laths, Screw Machine Work, Milling Machine Work, Metal Spinning, Metal Drawings, Castings, Finishing of all kinds, Enameling, Japanning, Tinning, Galvanizing, Wood and Metal Patterns, Drafting, Designing, Blue-print Work. Send sample for expert advice. Our 25c book free, containing tables and valuable information. Write for it today. Address THE EAGLE MFG. CO., 1621 Blue Rock St. Cincinnati, O.

ELECTRIC LIGHTING FOR AMATEURS. How a small and simple experimental installation can be set up at home. Scientific American Supplement 1551. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

Print Your Own cards, circulars, book, newspaper, etc. Press \$5. Larger \$10. Rotary \$20. Save money. Print for others. All over rules sent. Write factory for press catalog, TYPE, cards, paper, samples, etc. THE PRESS CO., Meriden, Conn.



A Man's Mail Will Reach Him Where No Mortal Can

## MAILING LISTS

99% GUARANTEED covering all classes of business, professions, trades or individuals. Send for our complete catalog showing national count on 7,000 classifications. Also special prices on fac-simile letters.

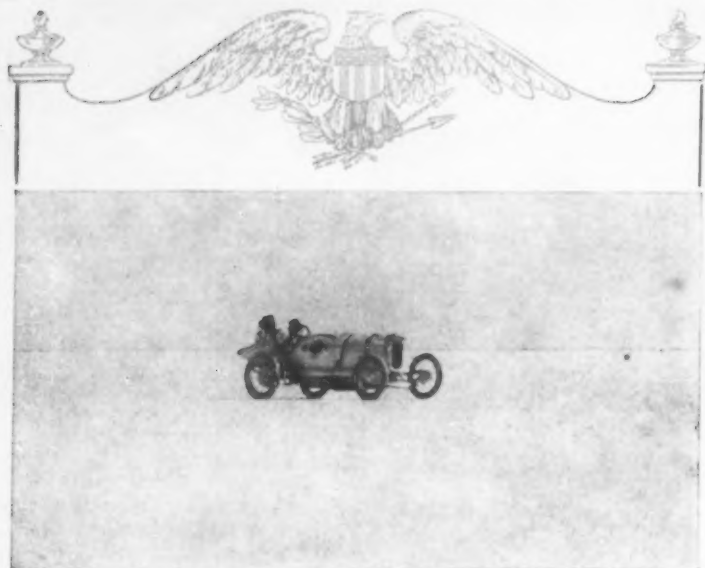
ROSS-GOULD, 412-R N. 9th St., ST. LOUIS

Fish Bite Like hungry wolves bait with Magic-Fish-Lure. Beat fish bait ever discovered. Keeps you busy pulling them out. Write to-day and get a box to help introduce it. Agents wanted. J. F. Gregory, Dept. 31 St. Louis, Mo.

## Santilite Composition Flooring

Round Corners. Santilite Composition Flooring is inexpensive, durable, almost noiseless. Easy to walk and stand on, non-slippery, easily cleaned and because of its resiliency will not crack under ordinary structural strains. Santilite is easily laid over any old or new floor. It is fire, water, and germ proof, and absolutely sanitary. Also used for patching and leveling rutted cement floors. Send us size of rooms that need new floors. We shall be pleased to quote you, send samples and descriptive literature. State color preferred, Tile Red, French Gray, Buff, or Nile Green. For Home, Office, Factory, Hospital, Public Buildings, or any place that a floor is necessary. Sanitary Composition Floor Co., 335 West Fayette St., Syracuse, N. Y. Base and Floor One Continuous Piece.





**T**HROUGH its Motor Department, conducted by H. W. Slauson, M. E., Leslie's acts as an unbiased confidential advisor to its readers. 62% of the inquirers (who replied to his test follow-up) bought cars immediately after receiving his advice; 13% intended to buy at an early date; the other 25% deferred purchasing. 88% of the motorcycle inquirers who replied, purchased. 120 of the pleasure cars represented an expenditure of nearly \$150,000.

Our editorial service to motorists goes greatly beyond the Motor Department page in the second and fourth issues each month; any Leslie's motorist can get authentic and prompt information, maps, etc., direct by mail.

Motorists consider this service alone worth more than the \$5, which is Leslie's subscription price. Yet the Motor Department is only one of the worth while features of

**Leslie's**  
Illustrated Weekly Newspaper  
225 Fifth Ave., NEW YORK

## The Preservation of Wood

**O**UR forests are growing smaller every day; the supply of timber is rapidly diminishing and its price is constantly increasing. Anything therefore that will promote economy is of vital interest. The preservation of wood, and the prolongation of its useful life is a most practical method of economy, as it not only saves the cost of new material but also avoids the heavy incidental expenses of making the renewals.

Valuable papers on the Preservation of Wood, and the various methods employed, have been published in the Scientific American Supplement from time to time, which cover this important subject quite fully. The list includes the following titles:

Each number of the Supplement costs 10 cents

A set of papers containing all the articles here mentioned will be mailed for \$1.00.

The Hasselmann Pickling Process for Mine Timber. By Dr. Max Krause. Scientific American Supplement No. 1200.

The Rapid Ageing and Fireproofing of Wood. Scientific American Supplement No. 1392.

Preservation of Wood. Scientific American Supplement No. 1440.

A New System of Seasoning Wood with Saccharine or Sugar. Scientific American Supplement No. 1444.

History of Timber Treatment. By Walter W. Curtis. Scientific American Supplement No. 1494.

The Powell Process of Preserving Wood with Saccharine. Scientific American Supplement No. 1636.

The Steaming of Timber. By Octave Chanute. Scientific American Supplement No. 1664.

Wood Preservation. The Meaning of Decay and How It May Be Checked. By W. F. Sherzer. Scientific American Supplement No. 1700.

Destructive Marine Wood Borers. Various Methods of Protecting Timber Structures. Scientific American Supplement No. 1722.

Fireproofing Wood and Textiles. Scientific American Supplement No. 1752.

Preservative Treatment of Farm Timbers. What Every Farmer Ought to Know. By C. P. Willis. Scientific American Supplement Nos. 1806 and 1809.

How Wood Is Artificially Aged. The Coloration of Wood by Gases and Fumes. By H. Wislizenus. Scientific American Supplement No. 1815.

Development and Status of the Wood Preserving Industry. Notes on the Art as Practiced in America. By E. A. Sterling. Scientific American Supplement No. 1956.

The Preservation of Wood. A Synopsis of the Principal Processes in Use Today. By A. J. Wallis-Taylor. Scientific American Supplement Nos. 2012, 2013 and 2014.

Norden Electrical Process for Rapid Drying and Preserving of Wood. Scientific American Supplement No. 2026.

Order from your Newdealer or from

**MUNN & CO.**  
Inc.  
PUBLISHERS  
361 BROADWAY  
NEW YORK CITY

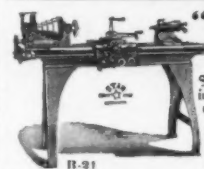
In the car is carried along with the car, and is at rest with reference to the car. A bird or anything else floating in the air in the car is carried along in the same way, and will not be moved toward the rear end of the car. If there was a draught of air toward the rear of the car, you would feel it on your face and the feathers on the hats of passengers would be blown by the wind caused by the drifting of the air toward the rear of the car. 2. Which end of the Panama Canal is the higher, if either—the Pacific or the Atlantic? A. The ocean ends of the Panama Canal are at the same level. There is no difference of level between the Atlantic and Pacific oceans. There is a difference between the rise and fall of the tides at the two ends of the canal. At Colon the total change of level of the tides is 2.5 feet and at Panama it is 21.1 feet. The difference in level on the two sides varies thus 18.6 feet. This is wholly due to the rise and fall of the tides, and not to any difference of level between the two oceans. These figures are taken from an address by Col. Goethals before the National Geographic Society, for which see the *National Geographic Magazine* for February, 1911, page 155.

(13053) S. G. asks: In order to determine a question which has arisen between several friends and myself, I am taking the liberty of asking the following questions: Is it possible for any form of life, particularly the lower forms of insect life, to be produced spontaneously? The reason I am asking these questions is because the assertion was made several days ago that some kinds of insects, such as lice, ants, bedbugs, etc., appear without any reason for so doing. This statement appears to me to be utterly absurd and without any foundation of fact, but seems to be a very popular belief. For instance, it was said that if two flat pieces of a certain kind of wood were dampened and placed together, and left for the proper length of time, a certain species of bedbug, known as a wood bedbug, would be found. Another said that certain varieties of worms were generated from decayed wood, and also that ants appeared in places where it was impossible for them to enter. Still another believes in the horsehair snake superstition, so it is in the belief that you can clear up some of these stupid beliefs that I am writing you at such length. Perhaps you can also explain the wrigglers in vinegar and the mites in cheese. A. No life has yet been produced from lifeless matter spontaneously. In all the experiments in that direction the experiment begins with organic matter. It must be evident to you that if two pieces of wet wood are laid away there must be many germs upon their surfaces, some of which may go on and produce forms of living creatures. The experiment which you describe is not a scientific experiment at all. It does not exclude the germs of living creatures. The hair-like worm to which you refer is the *Gordius aquaticus*, which is fully described in the books upon zoology. It is a parasite in locusts and some other insects for a part of its life, and spends another part in certain fishes. In its final state it is a free-swimming, snake-like worm, which many ignorant persons suppose to be a transformed horsehair. The vinegar eel is also a worm, known in science by the name *Anguillula aceti*, or the little snake of vinegar. The cheese mite is not a worm, but an insect, which occurs in cheese and flour and in milk. Packard's "Zoology" describes all these. We send the book for \$2.50. The cheese mite is known in zoology as the *Tyroglyphus siro*. There is a variety which is found in fermenting sugar. It is often shown upon dates by the vendors of cheap microscopes, just as the vinegar eel is shown.

(13054) E. S. B. asks: I inclose a clipping from a recent periodical entitled "Falling East," which is so entirely contrary to generally accepted notions that I would be very glad indeed to have an expression of opinion from someone who is able to either substantiate or prove the errors of this article. A. The idea that the rotation of the earth ought to cause bodies dropped upon its surface to fall to the east of the point directly below that from which they were dropped was first suggested by Sir Isaac Newton near the beginning of the eighteenth century. Up to recent years the best experiments upon this matter were performed at Hamburg, Germany, in 1802, and at Freiburg, in Saxony, in 1831. The experiments are difficult because of air currents, and also because a ball which is not perfectly spherical will sheer off to one side or the other in falling. The German experimenters had only 530 feet of fall for their balls, and obtained an eastward deviation of 1.24 inches. In the experiments described in the article "Falling East" the Americans had a mine shaft 5,300 feet deep into a copper mine at Calumet, Mich. At Calumet the surface of the earth is moving eastward about 1,000 feet a second. At the depth of 5,000 feet the eastward motion is about 4 inches per second less than the surface. To drop the 5,000 feet without any resistance from the air would require 17 1/2 seconds, and it would in that time deviate toward the east about 6 feet. But the resistance of the air would greatly increase the time of fall, so that the eastward deviation would be much more than 6 feet. A ball which was started from a point 4 feet from the wall was found lodged in the timbers on the east side of the shaft 800 feet below the surface. Another ball was never found. It is hidden somewhere along the east side of the shaft. An inference from this is that a load of ore dropped into the shaft at its mouth would be found scattered along the east wall of the shaft, or in the lower levels on the east side of the shaft. Our information is obtained from an article in *Machinery*, New York, for February, 1914, which reports the work of the party from the Michigan School of Mines at Houghton, Mich., which is in the copper country, only a few miles from Calumet.

## ADVERTISING CLASSIFIED

### LATHES AND SMALL TOOLS



**"STAR" Large Line of Attachments For Foot or Power LATHES**

Suitable for fine accurate work in the repair shop, garage, tool room and machine shop. Send for Catalogue B. **SENECA FALLS MFG. CO.** 695 Water Street Seneca Falls, N. Y., U.S.A.

## WORK SHOPS

of Wood and Metal Workers, without steam power, equipped with

### BARNES' Foot Power MACHINERY

allow lower bids on jobs and give greater profit on the work. Machines sent on trial if desired. Catalog free.

W. F. & JNO. BARNES CO.

1999 Ruby Street Rockford, Illinois

Established 1872

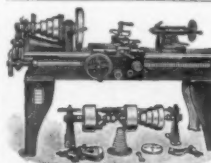
### "RED DEVIL" MAGAZINE GLASS CUTTER No. 6.

In snap-button kid case. Six extra wheels in handle. One of 40 styles. If you dealer has none, send 30 cents for sample. More "Red Devils" used than all others combined. Send for Booklet of 3000 "Red Devils". **Smith & Hemenway Co.** 155 Chambers St. New York City.

## GROBET SWISS FILES

Are the standard of excellence in files, and have been for over 100 years. We send postpaid as an inducement 48 files especially adapted for tool makers and machinists on receipt of \$5.00. This is a chance to get a set of files you'll appreciate and we'll get future orders.

**MONTGOMERY & CO.** 109 Fulton Street New York City



**OUR BIGGEST LATHE VALUE.** 16-inch Lathe with 6-foot bed, \$25.00; other sizes at proportionately low prices. Every lathe guaranteed. Buy your lathe from us and save \$50.00 or more. Machinery Catalog No. 7031 sent free on request. **SEARS, ROEBUCK AND CO., Chicago.**

## WELL DRILLING WELL PAYS WELL

Own a machine of your own. Cash or easy terms. Many styles and sizes for all purposes. Write for Circular. **WILLIAMS BROS., 434 W. State St., Itasca, N.Y.**

## ADVERTISING CLASSIFIED

### SPECIAL MACHINERY

#### MANUFACTURING

WE HAVE FACILITIES FOR THE MANUFACTURE OF Specialties in Both Metal and Wood and would be glad to quote prices for experimental work or regular manufacturing. Address: Specialties, Box 73, N. Y.

### NOVELTIES & PATENTED ARTICLES

MANUFACTURED BY CONTRACT. PUNCHING DIES. LIGHT AUTOMOBILE STAMPINGS. **E. KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.**

## MODEL MAKING

Clock movements, spring motors and parts manufactured. Fine die and tool work.

**LUX CLOCK CO., Inc., Waterbury, Conn.**

## MODEL, EXPERIMENTAL and DEVELOPMENT WORK

Specialists in Clock and Instrument design. Our Engineering Staff is at your service. **LOCKWOOD & ALMQUIST, Inc., 112 East 19th St., N.Y. City**

## Models and Experimental Work

INVENTIONS DEVELOPED SPECIAL MACHINERY . . .

**E. V. BAILLARD CO., 24 Frankfort St., N. Y.**

**LEARN WATCHMAKING** and become independent. Refined, profitable labor, Good-Paying Positions Secured. Competent men always in demand. Easy to learn; money earned while studying. Write for our Catalogue. Address, **St. Louis Watchmaking School, Dep't 6, St. Louis, Mo.**

**MASON'S NEW PAT. WHIP HOIST** for Outrigger hoists. Faster than Elevators, and hoist direct from tanks. Saves handling at less expense. Manufactured by **VOLNEY W. MASON & CO., Inc.** Providence, R. I., U. S. A.

## EXPERIMENTAL and Model Work

Electrical and Mechanical devices built to order strictly confidential. Up-to-date Equipment.

**Startlight Machine Works** 136-140 West 52d St. Phone, Columbus 5351



# Danger Pennies

*How false economy in lubrication often proves a boomerang*

**L**ET us look at some plain arithmetic. Suppose your car cost \$1200.

At the end of the year, you reckon expenses and, roughly, you find:

Depreciation in selling value, say \$400.  
Tires, approximately 100.  
Repairs ?  
Gasoline, 5000 miles at 1c a mile 50.  
Insurance, say 65.  
Lubrication, perhaps as much as 10.  
**\$625. plus**

Lubrication comes last—  
at a trivial \$10. a year.

It is a human failing to treat such small outlays lightly.

Some motorists do not yet realize that oils which can be sold at pared-down prices cause pared-down efficiency, and send total yearly expenses up—not by mere penny steps but by real dollar leaps.

Consider *depreciation*: Why does it loom up so large?

*Not enough attention to that \$10. a year.* When all cars are given efficient oil for their motors, automobiles will command higher resale prices.

Trace back most *repair bills* and again you find—*not enough attention to that \$10. a year.*

*Gasoline consumption mounts up.* The experienced motorist knows that efficient lubrication insures a higher mileage from gasoline.

This is certain: Cheap, poor-wearing oils make noisy, quick-wearing motors.

And worn motors soon wear out.

If you use the grade of Gargoyle Mobiloils specified for your car in the chart below, you may spend an added few cents a gallon. But the gallon "wears" longer.

Gasoline mileage is increased and avoidable repair bills and depreciation are eliminated, adding years to the life of your car.

If you decide in favor of *true* economy in lubrication, you will find your scientific guide in our Chart of Automobile Recommendations which represents our professional advice.

If your car is not listed, a complete chart will be sent you on request.

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container.

The four grades of Gargoyle Mobiloils for motor lubrication, purified to remove free carbon, are:

**Gargoyle Mobiloil "A"**  
**Gargoyle Mobiloil "B"**  
**Gargoyle Mobiloil "E"**  
**Gargoyle Mobiloil "Arctic"**

For information, kindly address any inquiry to our nearest office.

**VACUUM OIL COMPANY**  
Rochester, N. Y., U. S. A.

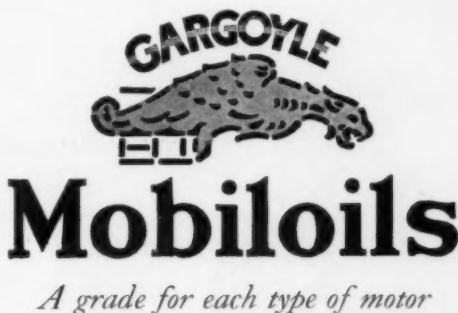
Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.

Domestic Branches:  
Detroit New York Philadelphia Minneapolis  
Boston Chicago Indianapolis Pittsburgh

## A guide to correct Automobile lubrication

**Explanation:** In the schedule, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example: "A" means Gargoyle Mobiloil "A." "Arc." means Gargoyle Mobiloil "Arctic." For all electric vehicles use Gargoyle Mobiloil "A" for motor and enclosed chains. For open chains and differential use Gargoyle Mobiloil "C."

| MODEL OF           | 1911   | 1912   | 1913   | 1914   | 1915   |
|--------------------|--------|--------|--------|--------|--------|
| CARS               | Summer | Winter | Summer | Winter | Summer |
| Abbott Detroit     | A      | Arc.   | A      | Arc.   | A      |
| Alco               | Arc.   | Arc.   | Arc.   | Arc.   | Arc.   |
| American           | A      | Arc.   | A      | Arc.   | A      |
| Apperson           | Arc.   | Arc.   | Arc.   | Arc.   | Arc.   |
| Auburn (4 cyl.)    | A      | A      | A      | A      | A      |
| " (6 cyl.)         | A      | A      | A      | A      | A      |
| Autocar (2 cyl.)   | A      | Arc.   | A      | Arc.   | A      |
| " (4 cyl.)         | A      | A      | A      | A      | A      |
| Avery              | A      | E      | A      | A      | A      |
| " (Model C) 1 Ton  | A      | A      | A      | A      | A      |
| Buick              | A      | Arc.   | A      | Arc.   | A      |
| Cadillac           | Arc.   | Arc.   | Arc.   | Arc.   | Arc.   |
| " (8 cyl.)         | A      | A      | A      | A      | A      |
| Cartercar          | A      | E      | A      | E      | A      |
| " Com'l.           | A      | A      | A      | A      | A      |
| Case               | A      | A      | A      | A      | A      |
| Chalmers           | A      | Arc.   | Arc.   | Arc.   | A      |
| Chandler           | A      | Arc.   | Arc.   | Arc.   | Arc.   |
| Chase (air)        | B      | B      | B      | B      | B      |
| " (water)          |        |        |        |        |        |
| Chesterfield six   |        |        |        |        |        |
| Chevrolet          |        |        |        |        |        |
| Cole               | A      | Arc.   | Arc.   | Arc.   | Arc.   |
| Cunningham         | A      | A      | A      | A      | A      |
| Delaney-Belleville | B      | A      | B      | A      | B      |
| Detroit            |        |        |        |        |        |
| " (8 cyl.)         |        |        |        |        |        |
| Dodge              |        |        |        |        |        |
| E. M. F.           | Arc.   | Arc.   | Arc.   | Arc.   | Arc.   |
| Empire             | A      | Arc.   | A      | Arc.   | A      |
| Fiat               | B      | A      | A      | B      | A      |
| Flanders           | E      | E      | Arc.   |        |        |
| " (6 cyl.)         |        |        |        |        |        |
| Ford               | E      | E      | E      | E      | E      |
| Franklin           | A      | Arc.   | A      | Arc.   | A      |
| " Com'l.           | B      | A      | A      | A      | A      |
| Garford            | A      | E      | Arc.   | Arc.   | A      |
| " Com'l.           | A      | Arc.   | Arc.   | Arc.   | A      |
| Grant              |        |        |        |        |        |
| Havers             | A      | Arc.   | A      | Arc.   | A      |
| " (Model 6-60)     |        |        |        |        |        |
| Haynes             | A      | Arc.   | A      | Arc.   | A      |
| Hudson             | A      | Arc.   | A      | Arc.   | A      |
| Hupmobile          | A      | Arc.   | A      | Arc.   | A      |
| " (Model 20)       |        |        |        |        |        |
| I. H. C. (air)     |        |        |        |        |        |
| " (water)          |        |        |        |        |        |



| MODEL OF          | 1911   | 1912   | 1913   | 1914   | 1915   |
|-------------------|--------|--------|--------|--------|--------|
| CARS              | Summer | Winter | Summer | Winter | Summer |
| International     | B      | B      | B      | A      |        |
| Interstate        | A      | Arc.   | A      | Arc.   | A      |
| Jackson           | A      | Arc.   | A      | Arc.   | A      |
| Jeffery           |        |        |        |        |        |
| " Com'l.          |        |        |        |        |        |
| Kelly Springfield | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| King              | A      | E      | A      | E      | A      |
| " (8 cyl.)        |        |        |        |        |        |
| Kissel Kar.       | A      | Arc.   | A      | Arc.   | A      |
| " Com'l.          | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| " (Model 48)      |        |        |        |        |        |
| Kline Kar.        | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Knox              | B      | A      | B      | A      | B      |
| Krit              | A      | A      | A      | A      | A      |
| Lippard Stewart   |        |        |        |        |        |
| Locomobile        | Arc.   | Arc.   | Arc.   | Arc.   | E      |
| Lozier            | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Lyons Knight      |        |        |        |        |        |
| Mack              | A      | E      | E      | E      | A      |
| " (Model S)       |        |        |        |        |        |
| Marion            | A      | E      | A      | Arc.   | A      |
| Marmon            | A      | Arc.   | A      | Arc.   | A      |
| Maxwell           | Arc.   | Arc.   | Arc.   | Arc.   | A      |

| MODEL OF         | 1911   | 1912   | 1913   | 1914   | 1915   |
|------------------|--------|--------|--------|--------|--------|
| CARS             | Summer | Winter | Summer | Winter | Summer |
| Mercer           | A      | Arc.   | A      | Arc.   | A      |
| " (22-70 Series) | A      | Arc.   | A      | Arc.   | A      |
| Metz             | A      | Arc.   | A      | Arc.   | A      |
| Mitchell         | A      | Arc.   | A      | Arc.   | A      |
| Moline           | A      | Arc.   | A      | Arc.   | A      |
| " Knight         |        |        |        |        |        |
| Moon (4 cyl.)    | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| " (6 cyl.)       |        |        |        |        |        |
| National         | A      | A      | A      | A      | A      |
| Oakland          | A      | Arc.   | A      | Arc.   | A      |
| Oldsmobile       | A      | Arc.   | A      | Arc.   | A      |
| Overland         | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Packard          | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Paige            | A      | Arc.   | A      | E      | A      |
| " (6 cyl.)       |        |        |        |        |        |
| Pathfinder       |        |        |        |        |        |
| Peerless         | Arc.   | Arc.   | Arc.   | Arc.   | Arc.   |
| Pierce Arrow     | A      | Arc.   | A      | Arc.   | A      |
| " Com'l.         | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Pope Hartford    | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Premier          | A      | Arc.   | A      | Arc.   | A      |
| Rambler          | A      | Arc.   | Arc.   | Arc.   | A      |
| Regal            | A      | Arc.   | Arc.   | Arc.   | A      |
| Renault          | A      | Arc.   | A      | Arc.   | A      |
| Reo              | A      | Arc.   | A      | Arc.   | A      |
| S. G. V.         | B      | Arc.   | B      | Arc.   | A      |
| Saurer           | A      | Arc.   | A      | Arc.   | A      |
| Saxon            |        |        |        |        |        |
| Selden           | A      | E      | Arc.   | Arc.   | A      |
| Simplex          | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Speedwell        | A      | Arc.   | A      | Arc.   | A      |
| " Mead           |        |        |        |        |        |
| Stearns          | A      | Arc.   | A      | Arc.   | A      |
| " Knight         |        |        |        |        |        |
| " (Light 4)      |        |        |        |        |        |
| Stevens Duryea   | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Stoddard-Dayton  | A      | A      | A      | A      | A      |
| " Knight         |        |        |        |        |        |
| Studebaker       | A      | Arc.   | Arc.   | Arc.   | A      |
| Stutz            | A      | Arc.   | A      | Arc.   | A      |
| Velie (4 cyl.)   | A      | Arc.   | A      | Arc.   | A      |
| " (6 cyl.)       |        |        |        |        |        |
| Walter           | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| White            | Arc.   | Arc.   | Arc.   | Arc.   | A      |
| Willis Knight    |        |        |        |        |        |
| " Utility        |        |        |        |        |        |
| Winton           | Arc.   | Arc.   | Arc.   | Arc.   | A      |

# FATIMA

THE TURKISH BLEND CIGARETTE

Men like Fatima—  
like the good  
tobacco—like  
the blend—a  
“distinctively  
individual”  
character that  
pleases the  
whole country!

*Liggett & Myers Tobacco Co.*

20  
for  
15¢

